GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

FINAL

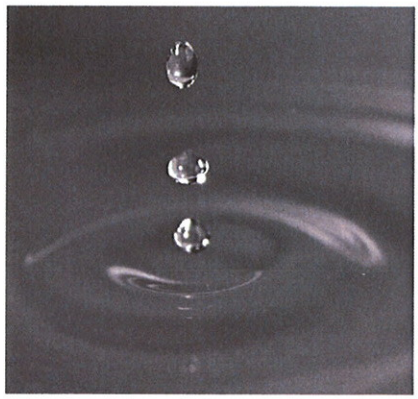
Coal Ash Impoundment - Specific Site Assessment Report Arizona Public Service

Four Corners Power Plant

Submitted to:
Lockheed-Martin Corporation
2890 Wood Bridge Avenue
Building 209 BAYF
Edison, NJ 08837

Submitted by:
GEI Consultants, Inc.
6950 South Potomac Street, Suite 300
Centennial, CO 80112

September 2009
Project 091330



Stephen G. Brown, P.E.
Senior Project Manager

Table of Contents

List of Tables

List of Figures and Exhibits

List of Figures in Appendices

List of Appendices

1.0 Introduction

1.1 Purpose

This report presents the results of a specific site assessment of the dam safety of Lined Ash Impoundment (LAI) embankment dam and Lined Decant Water Impoundment (LDWI) embankment dam at the Four Corners Power Plant in Fruitland, New Mexico. This assessment was performed on May 19th and 20th of 2009.

These impoundments were assessed because their failure may result in significant economic loss, environmental damage, disruption of lifeline facilities or loss of life (significant or high hazard according to U.S. Environmental Protection Agency (EPA) classification). The specific site assessment was performed with reference to Federal Emergency Management Agency (FEMA) guidelines for dam safety, which includes other federal agency guidelines and regulations (such as U.S. Army Corps of Engineers and U.S. Bureau of Reclamation) for specific issues, and defaults to state requirements where not specifically addressed by federal guidance or if the state requirements were more stringent.

1.2 Scope of Work

The scope of work between GEI and Lockheed-Martin Corporation for the site assessment is summarized in the following tasks:

1. Acquire and review existing reports and drawings relating to the safety of the project provided by the United States Environmental Protection Agency (EPA) and Owners.

2. Conduct detailed physical inspections of the project facilities. While on-site, fill out Field Assessment Check Lists provided by EPA for each management unit being assessed.

3. Review and evaluate stability analyses of the project's coal combustion waste impoundment structures.

4. Review the appropriateness of the inflow design flood (IDF), and adequacy of ability to store IDF, provision for any spillways, including considering the hazard potential in light of conditions observed during the inspections or to the downstream channel.

5. Review existing performance monitoring programs and recommend additional monitoring.

6. Review existing geologic assessments for the projects.

7. Submit draft and final reports.

1.3 Authorization

GEI Consultants, Inc., performed the coal combustion waste impoundment assessment for the EPA as a subcontractor to Lockheed Martin who is a contractor to the EPA. This work was authorized by the Lockheed-Martin under the P.O. No.: 7100052068; EAC #0-381 between Lockheed-Martin and GEI Consultants, Inc. (GEI), dated June 5, 2009.

1.4 Project Personnel

The scope of work for this task order was completed by the following personnel from GEI:

Stephen G. Brown, P.E.	Project Manager/Task Leader
Bryan Scott, P.E.	Project Geotechnical Engineer
Gillian Hinchliff	Staff Engineer
Dan Johnson, P.E.	Technical Reviewer

Program Manager for the EPA was Stephen Hoffman. Program Manager for Lockheed-Martin Corporation was Dennis Miller.

1.5 Limitation of Liability

This report summarizes the assessment of dam safety of the Lined Ash Impoundment and Lined Decant Water Impoundment coal combustion waste impoundments at Arizona Public Service, Four Corners, New Mexico. The purpose of each assessment is to evaluate the structural integrity of the impoundments and provide summaries and recommendations based the available information and on engineering judgment. GEI used a professional standard of practice to review, analyze, and apply pertinent data. No warrantees, express or implied, are provided by GEI. Reuse of this report for any other purpose, in part or in whole, is at the sole risk of the user.

1.6 Project Datum

All elevations in this report are New Mexico State Plane, Transverse Mercator-West Zone, NAD 1927 Horizontal, NAVD 1929 Vertical.

1.7 Prior Inspections

The LAI and LDWI embankment dams are inspected every 6 months by an APS Four Corners Plant Professional Engineer. The plant's Professional Engineers are registered with the State of New Mexico. The New Mexico Office of the State Engineer (OSE) Dam Safety Bureau last inspected the LAI and LDWI dams on October 4, 2007 and rated both of the impoundment dams as satisfactory.

2.0 Description of Project Facilities

2.1 General

Four Corners Power Plant is a coal-fired power plant consisting of five units that generate about 2,060 megawatts (MW). The Four Corners Power Plant is located in Fruitland, San Juan County, New Mexico approximately 20 miles west of Farmington, New Mexico, and about 13 miles southeast of Shiprock, New Mexico, see the attached Figure 1. The power plant is located south of Morgan Lake, and the Lined Ash Impoundment (LAI) and Lined Decant Water Impoundment (LDWI) are located just west of the power plant (Figure 2). The power plant is owned and operated by Arizona Public Service Company (APS) and the first unit went online in 1963.

2.2 Impoundment Dams and Reservoirs

LAI and LDWI embankments are classified by the New Mexico OSE Dam Safety Bureau as significant-hazard potential structures because of their intermediate heights, storage capacities, and economic risk to property and the environment. The basic dimensions and geometry of the LAI and LDWI are summarized in Table 2.1. The LAI embankment dam crest is at El. 5,248 for a total height of 83 feet; however, 43 feet of the height constitutes the underlying old ash impoundment #3 and #4. The LAI has a storage capacity of about 2,400 acre-feet. LAI has about 7 feet of freeboard at the time of this assessment and a design freeboard of 2.8 feet.

The LDWI dam crest is at El. 5,216 for a total height of 90 feet; however, 80 feet of the height constitutes the underlying old ash impoundment #3. The LDWI has a storage capacity of about 435 acre-feet. LDWI currently has about 5 feet of freeboard and a design freeboard of 2.8 feet. The LDWI is also identified as the Lined Decant Water Pond (LDWP) in APS documents.

The LAI embankments have a 15-foot-wide compacted clay lining on the upstream slopes with the remainder of the embankment constructed of bottom ash. The dam embankment has a crest 30 feet wide and upstream and downstream slopes varying from 3H:1V to 2H:1V, with several instances of 1.5H:1V where the slope height is relatively short. The LAI also has a single HDPE lining on the bottom and on the upstream slope of the impoundment.

The LDWI embankments on the north, east, and south sides are homogeneous embankments constructed of compacted clay. The west embankment is constructed of a 15-foot-wide compacted clay lining on the upstream slope with the remainder of the embankment

constructed of bottom ash. The dam embankment has a crest 30 feet wide and upstream and downstream slopes varying from approximately 3H:1V to 2H:1V. The LDWI has a dual HDPE liner with a leak detection system.

Table 2.1: Impoundment Dam Parameters Summary

Parameter	Value	
Dam	LAI Dam	LDWI Dam
Height (ft)	40 ft (plus 43 ft from old ash pond #3 and #4)	10 to 15 ft (plus 80 ft from old ash pond #3)
Length (ft)	Approx 4,534	Approx. 5488
Crest Width (ft)	30	30
Crest Elevation (ft)	El. 5248	El. 5216
Side Slopes (H: V)	3:1	3:1
Current Ash El. (ft)	El. 5241	El. 5211
Storage Capacity (ac-ft)	2,400	435
Surface Area (acres)	75	45

2.3 Spillways

The LAI dam and the LDWI dam do not have spillways.

2.4 Intakes and Outlet Works

The LAI dam has an 8-foot-diameter HDPE drop inlet decant structure. Two drainage pipes discharge decanted water from the LAI drop inlet structure to the LDWI; an 8-inch-diameter HDPE pipe at invert El. 5,213.5 and a 16-inch-diameter HDPE at invert El. 5,220 at the drop inlet structure. Both pipes exit the LAI at a 1 percent slope. The 16-inch-diameter pipe discharges by gravity over the top of the east embankment of the LDWI. The 8-inch-diameter HDPE pipe has a reverse slope where it is brought up and over the east embankment of the LDWI such that water remains in the pipe and flow does not occur until the height of water in the LAI exceeds the elevation of the intervening embankment (approx. El. 5,216). A third pipe, an 8 inch diameter perforated HDPE drainage pipe, also discharges into the LDWI from the LAI. A perforated length of this 8-inch pipe is located on the pond bottom in the southwest corner of the LAI. Water collected by the 8-inch perforated pipe flows by gravity to a downstream pump station where it is lifted into the LDWI.

The LDWI dam has no decant pipe or drop inlet. Water impounded by the LDWI is pumped to the power plant.

2.5 Vicinity Map

Four Corners Power Plant is located in Fruitland, New Mexico in San Juan County approximately 20 miles west of Farmington, as shown on Figure 1. The station is located at the south end of Morgan Lake, and the LAI and LDWI are located just west of the station. The nearest town downstream of the LAI and LDWI is Shiprock, New Mexico, which is located approximately 13 miles away.

2.6 Plan and Sectional Drawings

APS has prepared designs and initiated construction activities for a 10 foot raise of the LAI to El. 5,258. The design drawings for the El. 5,258 project (termed "5258 Lift") were considered to contain the most complete reference information regarding the El. 5,248 LAI structure for use during this assessment. Engineering drawings for the LAI proposed 5258 Lift are drawings numbered FC-C-41-ADS-156687-1 through FC-C-39-ADS-156687-18 dated October 29, 2007 through March 11, 2008 prepared by APS. Drawings that are generally descriptive of the impoundment structures are included in this report as Exhibits, as follows:

Exhibit 1 LAI Site Plan
Exhibit 2 LAI Embankment Sections (1 of 3)
Exhibit 3 LAI Embankment Sections (2 of 3)
Exhibit 4 LAI Embankment Sections (3 of 3)
Exhibit 5 LAI Soil Boring Logs
Exhibit 6 LAI Decant Drop Inlet Structure
Exhibit 7 LAI Instrument Locations

2.7 Standard Operational Procedures

A draft Operations and Maintenance Manual has been prepared and submitted to the New Mexico OSE for review and was not available for this assessment. The facility is manned full-time (24 hours a day and 7 days a week) and personnel perform daily inspections of the ash pond facilities. There have been no known spills or unpermitted releases for either the LAI or LDWI since being placed in service in 2004.

The plant's ash disposal area consists of an the LAI, the LDWI, a Dry Fly Ash Disposal Unit, and six old ash impoundments that are no longer in service. Based on available piezometer information, the old ash impoundments #3 and #4 that underlie the LAI and LDWI are mostly unsaturated and are expected to have only localized zones of perched water or saturation in low areas of the buried natural ground surface. The old ash impoundments that

the plant identifies as #3 and #6 are still inspected by the New Mexico OSE Dam Safety Bureau because APS has not yet submitted closure plans for those facilities.

The plant and ash processes are operated as a low volume water usage system. In the arid Four Corners climate, the annual pan evaporation exceeds precipitation by a factor of 5. The average annual precipitation is about 7.9 inches per year.

Wet bottom ash is removed from all five generating unit boilers and is slurried to collection bins for dewatering. The bottom ash is completely dewatered and then hauled by truck to the plant's Dry Fly Ash Disposal Unit. The majority of the generated bottom ash is used in the construction of site haul roads and embankments for future coal ash impoundments and expansions.

The fly ash from generating units 1, 2 and 3 is collected by venturi scrubbers (a wet particulate SO_2 removal system), slurried to thickener equipment for fly ash and FGD material concentration (water reduction), and then pumped to the plant's LAI for settling, dewatering, and storage. The fly ash slurry entering the LAI is about 35 percent solids. Water decanted from the LAI flows by gravity through a filter of bottom ash constructed around the perforated decant intake in the LAI, and then into the LDWI. Water is also decanted by an 8 inch diameter perforated HDPE pipe that lies on the bottom of the southwest corner of the LAI and that has continued to flow despite being buried by fly ash. This water flows by gravity to a downstream pump station where it is lifted into the LDWI.

The SO_2 from generating units 4 and 5 is removed from the flue gas by a wet spray tower scrubber system. The resulting FGD material is then pumped to thickener equipment, where it is concentrated before being pumped to the plant's LAI, where it is co-mingled with fly ash and FGD material from generating units 1, 2 and 3.

Water from the plant's low volume waste water system is pumped into a collection system sump from several sources within the plant. The water then flows by gravity out of the collection sump through the Low Volume Waste Water Decant Cells before flowing into the plant's Low Volume Waste Water Pond.

The performance of certain areas of the facility can be monitored by several instruments. The location and type of instrumentation is discussed in Section 5 of this report.

3.0 Summary of Construction History and Operation

The first unit of Four Corners Power Plant went online in 1963. Today, the plant has five generating units. Six old ash ponds are no longer in service. Historically, old ash ponds #3 and #4 were constructed as independent, unlined cells, contained by perimeter embankments and separated by a common earth embankment designated 3-4. There are no construction and/or design documents for the embankments. Fly ash was deposited into ash pond #4 at the east end as a slurry. The old 3-4 embankment had not been raised and ash ponds #3 and #4 became one unit. The old 3-4 common embankment was buried under the fly ash at shallow depth.

The west embankment for the LDWI also was constructed over, and tied into the underlying west embankment of old pond #3 and #4. The north, east, and south LDWI embankments were constructed directly on the fly ash within pond #3. The embankment of the Lined Decant Water Impoundment was built to the full height of approximately 10 to 16 feet in a single phase and was completed in 2003.

Embankments for the LAI were constructed over, and tied into, the underlying pond 3-4 clay embankments, with the exception of the northwest corner where the Pond 3-4 clay embankment could not be located. In this area, a 12-foot deep cutoff trench was excavated into the underlying old ash and backfilled with compacted clay for a length of several hundred feet. This length of cutoff trench does not achieve a positive seepage cutoff because it is terminated in the fly ash. The contents of the LAI overlie the fly ash contained within pond #4.

In 2003, the LAI was initially constructed to El. 5,228. In 2007, the second raise was constructed to its current crest El. 5,248. Each embankment raise or lift consists of a 15-foot-wide zone of compacted, relatively low-permeability clay on the upstream slope, a 30-foot-wide dam crest, and compacted bottom ash on the downstream slope. Both the upstream and downstream slopes vary from 3H:1V to 2H:1V, with several instances of 1.5H:1V where the slope height is relatively short. Currently, construction has begun for the next LAI raise to El. 5,258. The embankment geometry will remain essentially the same for the raise to El. 5,258.

APS plans to continue to raise the LAI embankment in 10-foot-elevation construction phases until the total height of the LAI is 70 feet with a dam crest elevation of El. 5,278 (for a total height of 113 feet including the underlying former ash pond 3-4 embankment). The

70-foot-high embankment will provide approximately 12 years of capacity for fly ash disposal in the LAI.

Three sides of the Lined Decant Water Impoundment dam embankment were constructed on top of the previously impounded slurried fly ash materials, whereas the west embankment was constructed over the underlying Pond 3 embankment, which is constructed of clay and bottom ash. Foundation preparation for portions of the dam constructed on the previously impounded fly ash included installation of a layer of compacted clay that may include a layer of biaxial geogrid reinforcement at some locations. Foundation preparation requirements to identify and remove poor quality zones, if any, of previously placed fly ash or natural ground were not specifically described on the available drawings. Evidence of prior releases, failures or patchwork construction were not observed or disclosed by plant personnel during the site visit.

The majority of the Lined Ash Impoundment dam embankment was constructed with the upstream portion of the dam on top of a previous clay embankment and the downstream portion either on the previously impounded slurried fly ash materials or on natural ground. Foundation preparation for the large height dam embankments constructed on the previously impounded fly ash included installation of a geogrid reinforced layer. The 2003 Geotechnical Analysis Report for the Lined Ash Impoundment describes the geogrid reinforced layer as consisting of a three foot layer of bottom ash that includes two layers of biaxial geogrid reinforcement layer separated by a 1 foot thick layer of bottom ash. Foundation preparation requirements to identify and remove poor quality zones, if any, of previously placed fly ash or natural ground were not specifically described on the available drawings. Evidence of prior releases, failures or patchwork construction were not observed or disclosed by plant personnel during the site visit.

4.0 Geologic and Seismic Considerations

The site is situated near the San Juan Basin of the Colorado Plateau Physiographic Province. The San Juan Basin which is a major source of oil, gas, coal and uranium in the state. The San Juan Basin formed during regional-scale compression during the Laramide Orogeny. Surficial geology at the site is composed of fine-grained deposits that are a residual soil of the weathered near-surface strata of the Cretaceous-age Lewis Shale. The impoundments area located about 8,500 feet east of the Hogback Monocline, which is the dominant tectonic feature in the area and constitutes the northwest margin of the San Juan Basin. The Hogback is a north-south trending monocline formed by steeply east-dipping Cliff House Sandstone.

No geologically young-aged faults have been mapped in the area, despite the evident bedrock deformations. The closest mapped faults to the site occur near Cortez, Colorado, approximately 35 miles north of the power plant, and approximately 50 miles to the southwest near the southern boundary of the Defiance Uplift.

A peak horizontal acceleration coefficient of 0.10g can be assigned to the site based on the 2008 United States Geological Survey (USGS) regional probabilistic seismic hazard map for 2 percent Probability of Exceedance within 50 years (recurrence interval of approximately 2500 years), which is a reasonable recurrence period for consideration for significant hazard classification impoundments.

5.0 Instrumentation

5.1 Location and Type

LAI instruments are all located on the west dam embankment of the LAI, as shown on Exhibit 7. The LDWI instruments, consisting of standpipe observation wells, are located around the perimeter dams of the LDWI.

5.1.1 Lined Ash Impoundment

- Vibrating Wire Piezometers for monitoring water levels at various depths in the underlying fly ash that forms the foundation of the LAI dams
- Settlement Plates for monitoring settlement of the dam and the underlying fly ash relative to natural ground foundation.
- Survey Monuments (benchmarks) for surveying control of vertical and horizontal movement of the dam

5.1.2 Lined Decant Water Impoundment

- Standpipe Piezometers for monitoring water levels at various depths in the dam foundation
- Survey Monuments (benchmarks) for surveying control of vertical and horizontal movement of the dam

5.1.3 Summary of Observation Well Locations

Six vibrating wire piezometers were installed on the west embankment of the LAI at locations shown on Exhibit 7. The piezometers were installed in clusters of 3 piezometers, each at different depths. A settlement plate was also installed in conjunction with piezometer clusters numbers 7, 8, and 9. The piezometer numbers with instrument measurement elevations are summarized in Table 5.1. These piezometers monitor water pressure head in the underlying Pond #4 fly ash that forms the foundation of the LAI west embankment.

Table 5.1: LAI Piezometer Information

Piezometer Number	Measurement Elevation (ft)
P-7.1	5196.9
P-7.2	5191.4
P-7.3	5184.8
P-8.1	5196.6

Piezometer Number	Measurement Elevation (ft)
P-8.2	5182.1
P-8.3	5174.1
P-9.1	5196.9
P-9.2	5184.0
P-9.3	5170.9
P-10.1	5198.2
P-10.2	5184.2
P-10.3	5173.7
P-11.1	5200.7
P-11.2	5189.7
P-11.3	5174.7
P-12.1	5202.5
P-12.2	5186.5
P-12.3	5176.5

Five observation wells were installed on the perimeter embankment of the LDWI in December 2003. The well numbers with depths are summarized in Table 5.2. These observation wells are screened to monitor water levels in the underlying Pond #3 fly ash and dam that forms the foundation of the LDWI perimeter embankment.

Table 5.2: LDWI Standpipe Observation Well Information

Well Number	Standpipe Bottom Depth (ft)	Monitoring Well Depth (ft)	Screen Depth (ft)
P-18	67	65	10
P-19	86	86	10
P-20	89	87.5	10
P-21	86	83	10
P-22	67	65	10

5.2 Time Versus Reading Graphs of Data

5.2.1 Lined Decant Water Impoundment

LDWI observation well water levels have been recorded monthly and the data versus time is summarized for the period July to December 2009 on Figure A-1 in Appendix A.

5.2.2 Lined Ash Impoundment

LAI piezometers have been monitored since January 2008. The piezometer readings are typically recorded monthly. Piezometer readings are submitted every 6 months to the NM OSE. The piezometric level data versus time are plotted on Figures A-2 to A-7 in Appendix A. The vertical movement devices (settlement plates) at LAI have also been monitored since January 2008. The vertical measurement device elevation data versus time data are plotted on Figure A-8 in Appendix A.

5.3 Evaluation of Instrument Data

5.3.1 Lined Ash Impoundment

The vibrating wire piezometers include a short length of porous tube and consequently represent a water pressure measurement at discrete depths. All LAI piezometer readings, except P-9.3 and P-12.3, indicate no saturation at the depth of the instrument. The deepest instrument is P-9.3, which is about 6 feet above the underlying weathered shale foundation material. The water pressure in P-9.3 has been steadily declining since January 2008 from about 4 feet of head to a January 2009 reading of 1 foot of head. Piezometer P-12.3 has risen steadily in 2008 from zero head to about 0.5 foot of head. Piezometers P-9.3 and P-12.3 may indicate localized perched water. Information on the potential for water in the lower 6 feet of the fly ash can be inferred from the nearby LDWI observation wells, which are screened at the bottom of the fly ash, or in the shale foundation. The LDWI observation wells are dry, indicating no water at those locations. The underlying fly ash foundation can be inferred to be generally unsaturated at the instrument locations based on this information. However, seepage noted at the downstream toe of the Pond #4 south embankment indicates the potential for localized saturation of the fly ash, likely to depths of a few feet or less. APS believes that the source of the seepage observed at the downstream toe is construction water that drains from the bottom ash placed to construct the LAI embankment and has found the seepage dries up within a few weeks of stopping construction of the embankment. The overall information is consistent with the LAI that includes an HDPE lining, and the investigation information that represents the underlying Pond #4 fly ash as unsaturated.

Settlement plates were installed into the shale foundation material at three locations along the downstream toe of the west embankment and will primarily measure settlement in the old fly ash that forms the foundation of the embankment. Settlement is expected to be nearly immediate in the unsaturated and moderately permeable fly ash. Vertical movement device data obtained since January 2008 indicate that settlements ranging from 0 to 6 inches have occurred. These settlements exceed the expected 1 inch settlement at the downstream toe and may represent disturbance of the settlement plate instruments. These instruments are located at the downstream toe of the existing 5248 embankment height and will not be subject to substantial vertical load until the dam embankments are raised 20 or more feet in the final phases.

5.3.2 Lined Decant Water Impoundment

The LDWI observation wells are screened at the bottom of the fly ash, or in the shale foundation. The LDWI observation wells are dry, indicating no water at those locations. The underlying fly ash foundation can be inferred to be generally unsaturated at the instrument locations based on this information. The instrument readings are consistent with the LDWI that includes a dual HDPE lining with leak detection system, and the investigation information that represents the underlying Pond #3 fly ash as unsaturated.

6.0 Field Assessment

6.1 General

Field observations of the Lined Ash Impoundment and Lined Decant Water Impoundment were made on May 20, 2009, by Messrs. Stephen G. Brown, P.E. and Bryan Scott, P.E., of GEI. The field assessment was attended by Mr. John Schofield of the USEPA – Region 9 and Messrs. David Bloomfield, P.E., Byron Conrad, P.E., and Bruce Salisbury, P.E., of Arizona Public Service Company.

The weather during the field assessment was generally clear, windy, and temperatures were warm. The discussions below are organized to follow the project from upstream (Lined Ash Impoundment) to downstream (Lined Decant Water Impoundment).

A copy of the field checklists are provided in Appendix B and photographs are provided in Appendix C. Sections 6.2 and 6.3 describe observations made during the inspection relative to key project features. Section 6.4 presents specific observations.

6.2 Lined Ash Impoundment

The LAI is formed by a perimeter dam having a crest elevation of El. 5,248. The dam is largely founded on the 40-foot-thick fly ash deposits in the underlying Pond No. 3, which is no longer in service. The dam section consists primarily of compacted bottom ash with a 15-foot-wide clay liner and 60-mil HDPE liner on the upstream slope. Construction activity has been initiated to raise the perimeter dam to El. 5,258 in accordance with a design that has been reviewed and approved by the New Mexico Dam Safety Bureau. At the time of the site visit the construction activity was limited to preparation of the dam crest and downstream slope area and initial placements of bottom ash fill on the dam crest. Field observations of the LAI included the dam crest and toe as well as observable features of the decant drop inlet and decant discharge pipes.

6.2.1 Dam Crest

The dam crest appears to be in good condition. We saw no obvious signs of settlement or displacement associated with the LAI.

6.2.2 Upstream Slope

The upstream slope of the dam, which consists of a 15 foot wide clay zone, is protected with an HDPE lining (Photo 2 in Appendix C). The upstream slope is mostly obscured by the HDPE lining. There was no visual evidence of slumps or bulges beneath the lining that would be indicative of stability issues. On this basis, the upstream slope was observed to be in good condition.

6.2.3 Downstream Slope

The downstream slope of the dam, which consists of compacted bottom ash, does not have additional erosion protection. Ponded water was observed at the downstream toe of the south embankment of the underlying Pond 3 & 4 embankment (see Photo 29). The seep occurs at a low point in the foundation topography and has been active for many years without significant change. The seep runs clear at a slow rate and there is no evidence of internal erosion of dam materials. There is no toe drain to collect and convey the water away from the embankment. The seepage is expected to reduce as the available water in the Pond 3 & 4 impoundment slowly drains. APS believes that the source of the seepage observed at the downstream toe is construction water that drains from the bottom ash placed to construct the LAI embankment and has found the seepage dries up within a few weeks of stopping construction of the embankment. The downstream slope was observed to be in generally good condition. No seepage was observed at the downstream toe in the northwest corner, where the cutoff trench does not tie in to the underlying 3-4 embankment.

6.2.4 Emergency Spillway

There is no emergency spillway for the LAI.

6.2.5 Outlet Works

The main structure is the decant inlet, which consists of a eight-foot-diameter HDPE manhole (3.6 inch wall thickness) that has been perforated with approximately one thousand ½-inch-diameter holes to serve as a subsurface drain in addition to functioning as a drop inlet (Photos 16, 17, 18, and 21). The HDPE manhole is founded on a concrete slab that forms the bottom of the decant inlet, but the HDPE riser is not embedded into the slab or otherwise positively connected to the slab. The water level in the decant inlet was above the lower 8-inch-diameter non-slotted HDPE discharge pipe and below the 16-inch-diameter non-slotted HDPE discharge pipe. The decant inlet appeared to be functioning satisfactorily and APS did not report any problems with its function to date. A perforated 8-inch-diameter HDPE pipe located on the pond bottom in the southwest corner of the pond and that serves to drain excess water from the pond could not be observed except where the discharge pipe enters the LDWI.

6.2.6 Internal Drains or Toe Drains

There are no internal or toe drains associated with the LAI.

6.2.7 Water Surface Elevations and Reservoir Discharge

The water surface in the LAI at the time of the site visit was at about El. 5,241, which provides 7 feet of freeboard. The LAI was discharging minor decant water flows to the LAI at the time of the site visit.

6.3 Lined Decant Water Impoundment

The LDWI is formed by a perimeter dam, which has a homogenous section constructed of compacted clay. Reduction of seepage and leakage from the pond is addressed by a dual 60-mil HDPE lining with leak detection system. The perimeter dam is primarily founded on the 40-foot-thick fly ash of Pond #3, which is no longer in service. Field observations of the LDWI included the dam crest and downstream slope and toe of the dam.

6.3.1 Dam Crest

The dam crest was generally level with exception of two areas on the west dam where material had been lost up to 18 inches in depth due to erosion by high winds (see Photo 36). We saw no obvious signs of settlement or displacement associated with the LDWI.

6.3.2 Upstream Slope

The upstream slope of the dam, which consists of a clay embankment on three sides and a 15-foot-wide clay zone on the west side, is protected with a dual HDPE lining with leak detection system (Photo 38). The upstream slope is mostly obscured by the HDPE lining. There was no visual evidence of slumps or bulges beneath the lining that would be indicative of stability issues. On this basis, the upstream slope was observed to be in good condition.

6.3.3 Downstream Slope and Toe

The downstream slope of the dam, which consists of compacted bottom ash, does not have additional erosion protection. The downstream toe of the west side of the dam could not be easily accessed on foot because it forms a nearly continuous slope with the underlying Pond #3 perimeter dam slope. Therefore, observations were made at the downstream toe of the west Pond #3 dam. Several tamarisk trees have become established at the downstream toe on the west dam and are near the perimeter seepage conveyance ditch that serves the old,

inactive, Pond #6. The tamarisk may be supported by water supply from the ditch or by seepage from the Pond #3 dam. These trees should be carefully removed and observations made frequently for potential seepage in this area. With exception of the trees, the downstream slope and toe was observed to be in generally good condition.

6.3.4 Emergency Spillway

There is no emergency spillway for the LDWI.

6.3.5 Outlet Works

Decant water flows by gravity into the LDWI from the LAI via 3 pipes. The LDWI does not have a gravity outlet from the pond. Water is pumped via pipes over the perimeter dam to return the water to the power plant for reuse.

6.3.6 Internal Drains or Toe Drains

There are no internal or toe drains associated with the LDWI.

6.3.7 Water Surface Elevations and Reservoir Discharge

The water surface in the LDWI was at El. 5,211 at the time of the site visit, which provides 5 feet of freeboard. Reservoir discharges are by pumping and it was not evident that pumping was in progress at the time of the site visit.

6.4 Field Assessment Observations

6.4.1 Settlement

No evidence of significant settlement of LAI or LDWI embankments was observed. Settlement associated with construction of the LAI perimeter dam is expected to have primarily occurred soon following construction due to the free draining properties of the bottom ash used to construct the dam and the moderate permeability, but unsaturated condition, of the underlying fly ash. Settlement of the north, east, and south LDWI clay embankments is expected to be minimal due to the low height of the embankment (maximum 15 feet).

6.4.2 Movement

No evidence was observed to indicate differential movement of LAI or LDWI structures.

6.4.3 Erosion

No significant erosion of the LAI dams or abutments, or LDWI dams, was observed.

6.4.4 Seepage

No evidence of significant seepage through the LAI or LDWI dam embankments. Evidence of seepage was observed at the downstream toe (old Pond #4) of the south embankment of the LAI. This has been an area of ongoing seepage according to APS and has not been associated with instability of the surrounding embankment. APS believes that the source of the seepage observed at the downstream toe is construction water that drains from the bottom ash placed to construct the LAI embankment and has found the seepage dries up within a few weeks of stopping construction of the embankment. Tamarisk trees growing at the downstream toe (old Pond #3) of the west embankment of the LDWI may be indicative of local seepage, but likely spread to the embankment slope from an adjacent grove of tamarisk that first became established on the banks of the nearby Pond #6 seepage ditch.

6.4.5 Leakage

No water leaks were observed from the project piping or structures.

6.4.6 Cracking

No cracks were observed in the upstream or downstream slopes or the crests of the dams.

6.4.7 Deterioration

No significant deterioration of LAI or LDWI dams and structures was observed.

6.4.8 Geologic Conditions

The geology of the LAI and LDWI project features is consistent with descriptions in the available reports. There have been no studies or events (landslide, earthquake, etc.) that would result in changes to the description of local geologic conditions.

6.4.9 Foundation Deterioration

No signs of foundation deterioration were observed for the LAI and LDWI dams.

6.4.10 Condition of Spillway and Outlet Works

There is no spillway at the LAI or LDWI. The LAI outlet consists of a decant drop inlet and perforated drain pipe. No adverse conditions were observed for the decant drop inlet and the perforated drain pipe could only be observed where it discharges to the LDWI. There is no outlet at the LDWI – water is removed by pumping back to the power plant.

6.4.11 Observations of Operation of the Spillway and Outlet Works

There is no spillway at the LAI. Based on the drawings and observed conditions, gravity flow from the decant drop inlet is controlled to approximate El. 5,216 where the two outlet pipes cross over the LDWI dam, with the 8 inch pipe being slightly lower than the 16 inch pipe. Therefore, decant water is charged in the low portion of the lower 8-inch-diameter outlet pipe at all times with a minimum of about 10 feet of head and would not flow until the decant water is a few inches below the upper 16-inch-diameter pipe. The lower 8 inch decant pipe conveys the majority of decant water flows, besides the 8 inch perforated collection pipe located at the bottom of the reservoir (southwest corner). According to APS personnel, the 16 inch pipe has rarely conveyed flows to date. The flowable backfill seepage control fill around the 8-inch pipe and the 16 inch pipe serves to address the potential reservoir head that could be applied to these locations should the LAI membrane lining be compromised.

6.5 Reservoir Rim Stability

There are no reservoir rim issues associated with perimeter dams such as LAI and LDWI.

6.5.1 Uplift Pressures on Structures, Foundations, and Abutments

There are no significant structures associated with the two impoundments. No evidence of uplift pressure issues was observed.

6.5.2 Other Significant Conditions

No other conditions were observed that would affect the safety of the project structures.

7.0 Spillway Adequacy

7.1 Floods of Record

Floods of record have not been evaluated for LAI and LDWI Dams.

7.2 Inflow Design Floods

Currently, the LAI and LDWI Dams are classified as a significant hazard potential structure by the NM OSE. Federal guidelines indicate that significant hazard dams be able to pass a flood equivalent to 50 percent PMP with a minimum of three feet of freeboard.

The LAI is designed as a perimeter dam with potential to receive only minor surface water run-on. The inflow flood will be limited to precipitation that falls directly on the reservoir itself. GEI was provided with limited information on the precipitation events associated with the Four Corners area. Based on the provided drawings, the dam has a 2.8-foot-freeboard and is capable of storing a 72-hour precipitation event of 10.9 inches, which is 100 percent of the PMP based on Hydrometeorological Report No. 49. The LAI does not have an emergency spillway. The maximum discharge through the drop inlet decant structure during this event was estimated to be 50 cfs. The LAI is designed to have capacity to store the inflow design flood.

The LDWI is designed as a perimeter dam with no potential to receive surface water run-on. The inflow flood will be limited to precipitation that falls directly on the reservoir itself. Based on the provided drawings, the dam has a 2.8-foot-freeboard and is capable of storing a 72-hour precipitation event of 10.9 inches, which is 100 percent of the PMP based on Hydrometeorological Report No. 49. The LDWI does not have an emergency spillway or an ungated gravity outlet works. Water levels in the LDWI are controlled by pumped discharge from the power plant (as decant from the LAI, maximum 500 gpm) and pumped discharge from the LDWI back to the power plant (maximum 400 gpm capacity). The LDWI is designed to have capacity to store the inflow design flood.

7.2.1 Determination of the PMF

The PMP was based on Hydrometeorological Report No. 49. The PMP is considered to fall directly on the reservoir because there is no contributing drainage area.

7.2.2 Freeboard Adequacy

The planned operating freeboard of 2.8 feet at the LAI and 2.8 feet at the LDWI is adequate to store the full PMP based on incipient rainfall on the reservoirs and no contributing drainage area.

7.2.3 Dam Break Analysis

A dam break analysis and inundation mapping has been documented for the LAI Dam and is currently being reviewed by NM OSE. For purposes of this review, this analysis is also considered generally applicable to the LDWI. The inundation is mapped downstream to where it flows from the Chaco River drainage to the San Juan River. No habitable structures were recorded during development of the inundation mapping and the flood outflow passes beneath the Highway N36 bridge. The dam break analysis and inundation mapping were not reviewed as part of this study.

7.3 Spillway Rating Curves

There are no spillways for the LAI or LDWI.

7.4 Evaluation

The capacity of the LAI and LDWI to store the inflow flood, which is the full PMP, within the available operating freeboard is considered to exceed the regulatory requirements for significant hazard impoundments.

8.0 Structural Stability

8.1 Visual Observations

The inspection team saw no visible signs of instability associated with the LAI and LDWI dams and dikes during the May 20, 2009, site assessment.

8.2 Field Investigations

A Geotechnical Analysis Report for the Lined Ash Impoundment Embankment was prepared (URS, 2003). An addendum was issued to address comments from the New Mexico OSE on the 2003 report (URS, 2008). Subsurface investigations performed at the site consist of:

- Eight test pits excavated by APS to investigate borrow sources for the clay liner system. Clay soil samples were obtained and laboratory testing consisting of gradation, Atterberg Limits, Standard Proctor, and direct shear tests.
- In 2002, AMEC drilled six soil borings to depths ranging from approximately 32 to 52 feet below grade in the fly ash. Standard Penetration Tests (SPT), vane shear tests, and one flexible-wall permeability test were performed as part of the investigation. Laboratory tests consisted of gradation and Atterberg Limits.
- ConeTec, Inc. performed 15 piezocone penetration tests for the proposed lined impoundment in 2002. Pore pressure dissipation tests were performed at selected depths at each location.

8.3 Methods of Analysis

The results of LAI slope stability analyses are reported in the 2003 and 2008 Geotechnical Analysis Reports (URS, 2003; 2008). The results of LDWI slope stability analyses are reported in the 2003 Geotechnical Analysis Report (URS, 2003).

8.4 Discussion of Stability Analysis

8.4.1 Lined Ash Impoundment

The results of slope stability analyses are reported in the 2003 and 2008 Geotechnical Analysis Reports. The 2003 study was completed to evaluate the stability of the proposed LAI in several increments up to the full planned height of 70 feet, and the 2008 report was completed to document stability factors of safety for the proposed 50 foot height based on revised New Mexico dam safety rules. The height of the LAI at the time of our site assessment was 40 feet.

The stability analyses completed as part of the 2003 study were used to evaluate the Factor of Safety of several critical sections. Using GSLOPE, by Mitre Software Corporation, stability under steady state seepage conditions was evaluated using the Bishop Method and the Janbu Method. For the seismic case, a pseudostatic acceleration of 0.05g was applied to the embankment based on one-half of the United States Geological Survey ground motion for an approximate 2,500 year return interval.

The material properties used in the stability modeling were based on laboratory testing of site-specific materials. GEI considers the selected materials properties to be appropriate for use in the stability analyses. The geometries of the modeled sections were based on the design geometry.

The phreatic surface used in the models was based on seepage output from the SEEP/W software by Geo-Slope International. This phreatic surface was based on steady-state seepage, modeling the ash as water and ignoring the HDPE lining.

Additional stability analyses were completed for the 50-foot-height LAI as part of the 2008 study. The same material properties were used for the raise analyses as were used for the initial analyses, with the exception of the properties for the compacted bottom ash. Based on testing during the construction of the 40-foot height impoundment, higher unit weight and friction angle were realized. These higher values were used for the design of the raise.

8.4.2 Lined Decant Water Impoundment

Stability of the LDWI was addressed in the 2003 report. The stability input/output files for the 2003 design report were not provided for review. A discussion of the slope stability analyses completed for the design of the LDWI is included in the 2003 report. The stability modeling was completed in GSLOPE using the Bishop Method and the Janbu Method. Two cross sections were analyzed for Full Reservoir- steady state seepage and Full Reservoir with seismic loading.

The factors of safety for the analyses were reported in the text; however the details of the analyses were not available. The material properties used in the stability modeling were the same as those used for the LAI.

Because the details of the analyses were not available, we have performed several stability analyses for the LDWI as part of the current review. The resulting factors of safety are discussed in the following section.

8.5 Factors of Safety

8.5.1 Lined Ash Impoundment

We reviewed the computed factors of safety for the embankment design up to El. 5,258 contained in the 2003 and 2008 reports. These reports indicate the factors of safety for static steady-seepage, earthquake (pseudostatic), and end of construction loading conditions meet or exceed the required minimum factors of safety as defined by the FERC and the New Mexico OSE Dam Safety Bureau. The criteria are minimum factors of safety of 1.5 for steady-state seepage, 1.1 for pseudostatic seismic stability, and 1.1 for end of construction.

8.5.2 Lined Decant Water Impoundment

We reviewed the computed factors of safety for the LDWI embankment stability analysis contained in the 2003 report. We compared the reported calculated factors of safety to minimum required factors of safety as currently required by the New Mexico OSE and the FERC. Because details of the specific analyses were not available for review, we performed stability analyses for a generalized geometry for the LDWI as part of our review. End of construction conditions were not analyzed for the LDWI in the 2003 report; however, the construction was completed several years ago and the analyses are not pertinent to current conditions.

Table 8.1: Stability Factors of Safety for Lined Decant Water Impoundment and Guidance Values

Loading Condition	Min. Reported FOS (2003 Report)	Min. Calculated FOS (GEI Review)	Min. Required FOS
Full Reservoir – Steady-state Seepage	1.40	1.38 (east embankment)	1.50
Full Reservoir – SS with pseudostatic earthquake (0.05g)	1.16	1.21	1.10

As indicated in Table 8.1, GEIs review calculation factor of safety of 1.38 for the steady seepage case is considered to verify the 1.40 factor of safety reported by APS in 2003, which met the minimum required factor of safety for NM OSE permitting at that time. Currently, the NM OSE required minimum factor of safety for steady-state seepage is 1.5, and the 2003 reported value is below this guidance value. Although the 2003 reported factor of safety does not meet current criteria, a conservative assumption was made in the analysis. The analyses assume that fully saturated steady state conditions develop within the clay embankment and also the nearly 80 feet of underlying fly ash. This condition is unlikely to occur given that the Lined Decant Water Impoundment contains a dual HDPE liner with a leak detection system, and piezometer data indicate that the majority of the fly ash is dry. It is reasonable to analyze the dam assuming full steady-state conditions in the clay embankment, but only partial depth saturation of the underlying fly ash. In this revised case, the factor of safety would be nearly 1.9 and would meet both the current New Mexico OSE and FERC minimum factor of safety for static steady seepage of 1.5.

8.6 Seismic Stability - Liquefaction Potential

The liquefaction potential at the various project features was evaluated in the 2003 study using procedures developed by Seed et. al. (1985) and Youd & Idriss (2001). The liquefaction potential was assessed at each of the CPT locations. The factors of safety against liquefaction were generally above 2.0, and were always greater than 1.5 indicating the potential for liquefaction at this site is low.

8.7 Decant Drop Inlet Structure

The decant drop inlet structure in the LAI is constructed of an 8-foot diameter Class 315 HDPE manhole that is founded on a concrete slab. At full impoundment build-out the manhole will be 70 ft high. The manhole is the primary means of removing decant water to the LDWI and is the sole means of discharging floodwater from the impoundment.

The manhole was designed by an APS professional engineer using calculations based on ASTM F-1759 and a calculation analysis provided by Performance Pipe, which is a division of Chevron Phillips Chemical Company LP. A copy of the manhole calculation input parameters and output was provided for review. The calculation, which is based on a solid wall HDPE manhole, indicates a factor of safety for radial loads of 3.6 and that other minimum safety factors for ring compressive strain, radial buckling, bending and compression, and wall axial strains are met.

The sensitivity of the structural analysis to varying the input parameters has not been evaluated in the provided information. The calculation assumed the water depth inside the manhole would be 20 feet. The calculation did not address potential range of internal water load ranging

from no water inside the manhole to full of water (assuming discharge pipes are plugged). The analysis did not appear to address the approximately 1,000 half-inch diameter holes and the 16 inch and 8 inch holes that penetrate the side of the manhole, though APS indicated their discussion with Performance Pipe indicated the contribution of the small holes could be neglected. The calculation did not address the potential consequences and vulnerability of the HDPE manhole not being embedded or otherwise positively connected to the concrete slab foundation and relies only on confinement provided by the surrounding fly ash. The upper part of the manhole is not protected from impacts from vehicles or large equipment that may be used to service the manhole, and a means of protecting the manhole should be provided.

8.8 Summary of Results

8.8.1 Lined Ash Impoundment

The stability analyses that have been performed for the LAI appear to adequately address the most critical sections. The analyses presented in the 2003 and 2008 reports addressing embankment heights up to El. 5,258 all meet the minimum required factor of safety criteria according to New Mexico OSE and the FERC guidance. These analyses include use of appropriate material properties and loading conditions.

8.8.2 Lined Decant Water Pond

The analyses performed in 2003 for the LDWI were not available for review. However, the reported factors of safety for the static steady-seepage loading condition does not meet the minimum values currently required by the New Mexico OSE and the FERC. GEI performed check analyses that resulted in a factor of safety for static steady–seepage of 1.4, which is similar to that reported in the 2003 report. As discussed in Section 8.5.2, the 2003 analysis was conservative and is considered to meet current guidance of 1.5 if the model is adjusted to reflect unsaturated conditions in the underlying fly ash, which is consistent with instrumented water level information in the fly ash.

The low factor of safety for static steady-seepage resulted from an analysis that assumed fully saturated conditions in the underlying fly ash, which may not be reasonable given the LDWI has a dual HDPE liner with a leak detection system and the unsaturated fly ash is nearly 80 feet deep. An analysis based on less depth of saturation in the fly ash was found to meet the required stability criteria.

8.8.3 Decant Drop Inlet Structure

The structural analysis of the HDPE decant drop inlet structure did not appear to address the sensitivity of the analysis to varying the input parameters including water depth and

penetrations of the manhole sides by pipes and many small drilled holes. The HDPE manhole may be vulnerable to differential movement between the manhole riser and the foundation slab because the riser is not embedded or otherwise positively connected to the concrete slab foundation. In addition, the upper part of the manhole is not protected from impacts from vehicles or large equipment that may be used to service the manhole.

9.0 Maintenance and Methods of Operation

9.1 Procedures

Arizona Public Service's experience with management of the coal combustion waste management system has resulted in the development of standard operational procedures to inspect, maintain, and operate the system. A draft Operation & Maintenance Manual is currently under review by the New Mexico OSE and was not available to the assessment team. Many of the plant engineers and operating personnel have been with the District for 10 years or more. The power plant is manned 24 hours a day, seven days a week. Daily inspection rounds are performed of the entire ash pond facilities by operations staff to observe the general condition of structures and embankments. Identified deficiencies are documented and repaired.

9.2 Maintenance of Impoundments

Maintenance of the two impoundments is performed by APS staff under the guidance of APS managers and engineers. Instrument readings are reported twice annually to the New Mexico Office of the State Engineer. Inspections are made every 6 months by APS engineers and on an irregular annual to multi-year schedule by New Mexico OSE personnel.

9.3 Surveillance

The entire project is patrolled daily by APS personnel. Plant personnel are available at the power plant and on 24-hour call for any emergencies that may arise. There are no automatic alarm systems at the impoundments.

10.0 Emergency Action Plan

An Emergency Action Plan (EAP) has been recently developed (draft EAP is currently under review by the New Mexico OSE). The EAP addresses dambreak analysis and inundation mapping for the Lined Ash Impoundment and the Lined Decant Water Impoundment. The inundation map indicates outflows resulting from a dam failure will be conveyed down the Chaco River drainage about 11 miles to the confluence with the San Juan River. No habitable structures were identified during development of the inundation mapping and the flood outflow passes beneath the Highway N36 bridge. The town of Shiprock is located about 13 miles downstream from the confluence of the Chaco and San Juan Rivers.

11.0 Conclusions

11.1 Assessment of Dams

11.1.1 Field Assessment

The LAI and LDWI dams were generally found to be in satisfactory condition. Issues of potential concern for the LAI and LDWI facilities were identified from our field assessment as follows:

- Seepage was observed at the downstream toe of the south embankment of the Pond 3 & 4 embankment, which underlies the LAI. The seepage is expected to reduce with time as the mostly unsaturated fly ash in the Pond 3 & 4 impoundment slowly drains. The seepage has been active for many years with no significant change. APS believes that the source of the seepage observed at the downstream toe is construction water that drains from the bottom ash placed to construct the LAI embankment and has found the seepage dries up within a few weeks of stopping construction of the embankment.
- Uneven dam crest at two locations on the west dam of the LDWI where wind erosion has contributed to loss of up to 18 inches depth of embankment material.
- Mature tamarisk trees have become established at the downstream toe of the west dam of the LDWI. This location is also the toe of the old Pond #3. The trees may be supported by seepage or by water flowing in a nearby ditch.

11.1.2 Stability Analysis (Adequacy of Factors of Safety)

The stability analyses addressing LAI embankment heights up to El. 5,258 all meet the minimum required factors of safety criteria according to New Mexico OSE and the FERC guidance. These analyses include use of appropriate material properties and loading conditions.

The analyses performed in 2003 for the LDWI report factors of safety for static steady-seepage and earthquake (pseudostatic) that do not meet minimum values required by the New Mexico OSE and the FERC. The low factor of safety for static steady-seepage resulted from an analysis that assumed fully saturated conditions in the underlying fly ash, which may not be reasonable given the LDWI has a dual HDPE liner with a leak detection system and the unsaturated fly ash is nearly 80 feet deep. An analysis performed for this study based on less depth of saturation in the fly ash was found to meet the required stability criteria. The 2003 factors of safety for the LDWI should be re-evaluated with more reasonable assumptions for

saturation levels in the underlying fly ash and compared with current criteria. While the 2003 factors of safety for the LDWI are somewhat below the required minimum, they are not considered deficient with respect to current guidance because the 2003 analysis was based on conservative assumptions and did not reflect the existing unsaturated condition of the underlying fly ash layer.

11.1.3 Stress Evaluation

A full review of the stress analysis of the decant drop inlet structure could not be performed because limited calculation information was provided. The provided structural analysis did not include a sensitivity analysis of the HDPE decant drop inlet structure to varying water depth and the influence of multiple penetrations of the manhole sides by pipes and many small drilled holes. The HDPE manhole was not evaluated for potential for differential movement between the manhole riser and the foundation slab, which lacks embedment or positive connection. The exposed part of the manhole is not protected from impacts from vehicles or large equipment that may be used to service the manhole.

11.1.4 Spillway Adequacy and Outlet Works

Both the LAI and LDWI do not have emergency spillways. However, they do have the capacity to store 100 percent of the PMF within the design freeboard, which is acceptable for these off-channel perimeter dam facilities that have no contributing drainage area and exceeds regulatory requirements for significant hazard impoundments.

The LAI has a decant drop inlet structure that serves as an outlet works. The decant drop inlet has a maximum capacity of 50 cfs assuming a flood surcharge of 3 feet. The LDWI does not have an outlet works. Water is recirculated back to the power plant from the LDWI by pumping. This method of water removal is considered adequate because both the addition of water (slurried fly ash) and removal of water from the LDWI are carefully monitored and controlled by pumps operated by the plant.

11.2 Adequacy of Instrumentation and Monitoring of Instrumentation

The frequency of monitoring is considered adequate. Instrumentation and monitoring programs are satisfactory except that special attention should be made to monitoring potential seepage under the dam at the northwest corner of the LAI and some of the settlement plates located in the west embankment of the LAI are not currently providing useful data. The northwest corner of the LAI is the area where the LAI embankment was not tied-in to the underlying Pond 3-4 embankment to provide continuity of seepage control. A deeper trench was installed and backfilled with clay. However, this cutoff trench location presents a potential seepage pathway should the HDPE lining fail. A potential seepage pathway would

be at the base of the permeable bottom ash at the contact with the less permeable fly ash. Additional piezometers are recommended for this area and the dam safety inspections should include documentation of any evidence of seepage near the downstream toe of the dam in this area.

Two of the three settlement plates in the west embankment of the LAI do not appear to be providing useful information and may have been damaged during construction or maintenance activities. Additional effort should be made to establish monitoring of settlement prior to the dam raise construction.

11.3 Adequacy of Maintenance and Surveillance

Both the LAI and LDWI have satisfactory maintenance and surveillance programs.

12.0 Recommendations

12.1 Corrective Measures for the Structures

12.1.1 Lined Decant Water Impoundment

1. The 2003 calculated factor of safety for static steady-seepage of 1.4 is somewhat below the current state and federal guidance of 1.5. Re-evaluation of this loading condition should be documented and may need to consider less conservative assumptions regarding saturation levels in the underlying fly ash. While the 2003 factors of safety for the LDWI are somewhat below the required minimum, they are not considered deficient with respect to current guidance because the 2003 analysis was based on conservative assumptions and did not reflect the existing unsaturated condition of the underlying fly ash layer.

2. The uneven dam crest on the west embankment should be restored to full height with compacted fill. This maintenance should be performed within the next six months.

3. Tamarisk trees should be removed from the downstream toe of the west embankment (Pond #3 toe) and an evaluation for any potential seepage should be performed in that area. However, instrumentation indicates the embankment is essentially dry and the trees may be supported primarily by water in the nearby Pond #6 seepage ditch.

12.1.2 Decant Drop Inlet Structure

1. Perform a structural analysis that includes a sensitivity analysis of the HDPE decant drop inlet structure to varying water depth and the influence of multiple penetrations of the manhole sides. Evaluate the decant structure for potential for differential movement between the manhole riser and the foundation slab. Provide protection for the exposed part of the manhole from impacts from vehicles or large equipment.

12.2 Corrective Measures Required for Maintenance and Surveillance Procedures

None.

12.3 Corrective Measures Required for the Methods of Operation of the Project Works

None.

12.4 Any New or Additional Monitoring Instruments, Periodic Observations, or Other Methods of Monitoring Project Works or Conditions That May Be Required

Continue monitoring seepage at the downstream toe of the south embankment (Pond #4 toe) for any changes in seepage quantity and flow rate or evidence that the flow is carrying soil/ash particles from the embankment.

Expand program to include additional monitoring of potential seepage under the dam at the northwest corner of the LAI, where the LAI embankment was not tied-in to the underlying Pond 3-4 embankment to provide continuity of seepage control, and where a potential seepage pathway exists if the HDPE lining fails. Install additional piezometers to address this potential seepage pathway and expand documentation in APS dam safety inspections to note any evidence of seepage near the downstream toe of the dam in this area.

Repair or replace the two settlement plates that do not appear to be providing useful information and that may have been damaged during construction or maintenance activities.

12.5 Acknowledgement of Assessment

I acknowledge that the management unit(s) referenced herein was personally inspected by me and was found to be in the following condition **(select one only):**

SATISFACTORY

FAIR

POOR

UNSATISFACTORY

DEFINITIONS FOR ASSESSMENT

SATISFACTORY
No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR
Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations

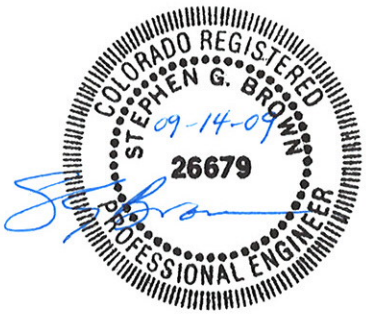
POOR
A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

UNSATISFACTORY
Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

I acknowledge that the management unit referenced herein:

Has been assessed on May 20, 2009 (date)

Signature: _____



List of Participants:

Stephen G. Brown, P.E.	GEI Consultants, Inc.
Bryan Scott, P.E.	GEI Consultants, Inc.
John Schofield	Environmental Protection Agency , Region 9
David Saliba	Arizona Public Service
David Bloomfield, PE	Arizona Public Service
Bruce Salisbury, ME, PE	Arizona Public Service
Byron Conrad, PE	Arizona Public Service
Carl Woolfolk	Arizona Public Service

13.0 References

Arizona Public Service Company, 2009, *Arizona Public Service Company's 104(e) Response for the Four Corners Generating Station,* Prepared for U.S. Environmental Protection Agency, March 26.

Arizona Public Service Company, 2007-2008, *Four Corners Common Ash Handling System Lined Ash Impoundment 5258 Lift,* Engineering Drawings, Sheets FC-C-41-ADS-156687-1 through FC-C-39-ADS-156687-18.

URS Corporation (URS), 2008, *Revised Addendum No. 1 Geotechnical Analysis Report Lined Ash Impoundment,* Prepared for Arizona Public Service Company, August 12.

URS Corporation (URS), 2003, *Geotechnical Analysis Report Lined Ash Impoundment Embankment,* Prepared for Arizona Public Service Company, January 15.

Federal Emergency Management Agency (FEMA), 2004, Federal Guidelines for Dam Safety, April.

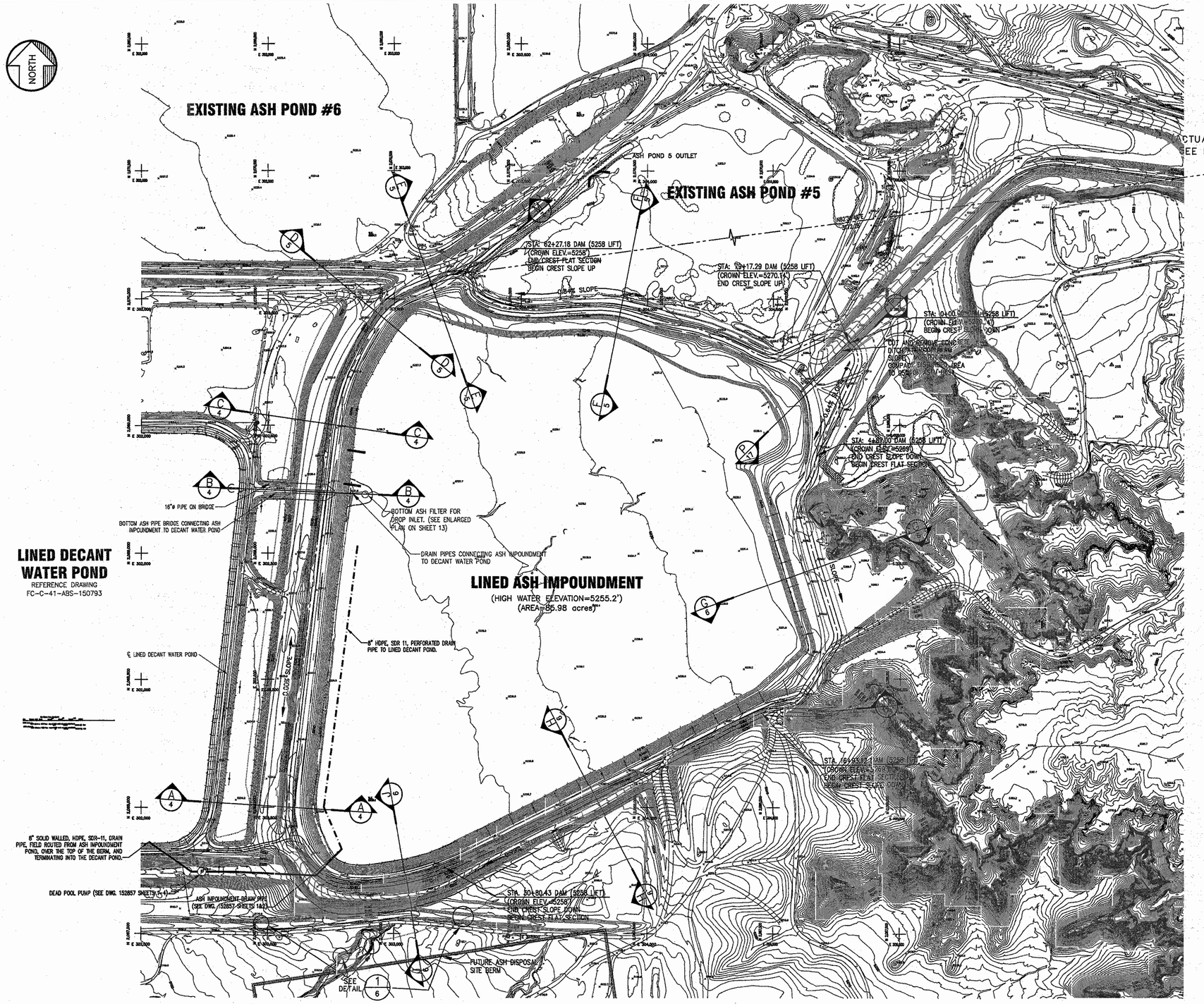
Figures and Exhibits

P:\091330 - Lockheed Martin Coal Ash Impoundments\APS\ FIGURE 1 SITE VICINITY MAP.dwg Sep 2009

Assessment of Dam Safety of Coal Combustion Waste Impoundments at APS Four Corners	GEI Consultants	SITE VICINTIY MAP
Lockheed-Martin Corporation Edison, NJ	Project 091330	September 2009 Figure 1

Assessment of Dam Safety of Coal Combustion Waste Impoundments at APS Four Corners		GEI Consultants	SATELLITE PHOTO
Lockheed-Martin Corporation Edison, NJ		Project 091330	September 2006 Figure 2

P:\091330 - Lockheed Martin Coal Ash Impoundments\APS\ figure 2 Satellite Photo.dwg Sep 2009



STATION NO.	NORTHING	EASTING
STA: 0+00.00	2069825	304801
STA: 4+87.00	2069383	304673
STA: 16+93.12	2068366	304450
STA: 30+80.43	2067762	303201
STA: 62+27.18	2070095	303230
STA: 79+17.29	2069828	304797

STATION POINTS - DAM
(TIED TO STATE COORDINATES)

REFERENCE:
FLOWN BY "AERO GRAPHICS, INC." ON NOVEMBER 23, 2006
40 W. OAKLAND AVE.
SALT LAKE CITY, UT 84115

LEGEND
- 5258 LIFT TOE
- 5258 LIFT CREST ?
- 5258 LIFT CREST
- A/3 — A/3 TYPICAL CROSS SECTIONS (SEE SHEETS 4-7)

BYRON R. CONRAD
NEW MEXICO
13248
REGISTERED PROFESSIONAL ENGINEER

FOR CONSTRUCTION

NORTH

SITE PLAN
SCALE: 1"=200'
CONTOUR INTERVAL=2'

GRAPHIC SCALE
200 0 200 400
(IN FEET)
1 inch = 200 ft.

DRAINAGE AREA DRAWING, SEE E-156687 SHEET #12

DATUM INFORMATION
CONTROL POINTS:
HV-53
SOUTHERN CALIFORNIA EDISON (SCE) BRASS CAP

NORTHING	EASTING	ELEVATION
N2,070,519.859	E306,365.846	5328.150'

NEW MEXICO STATE PLANE
TRANSVERSE MERCATOR-WEST ZONE
N.A.D. 1927

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
SITE PLAN

APS

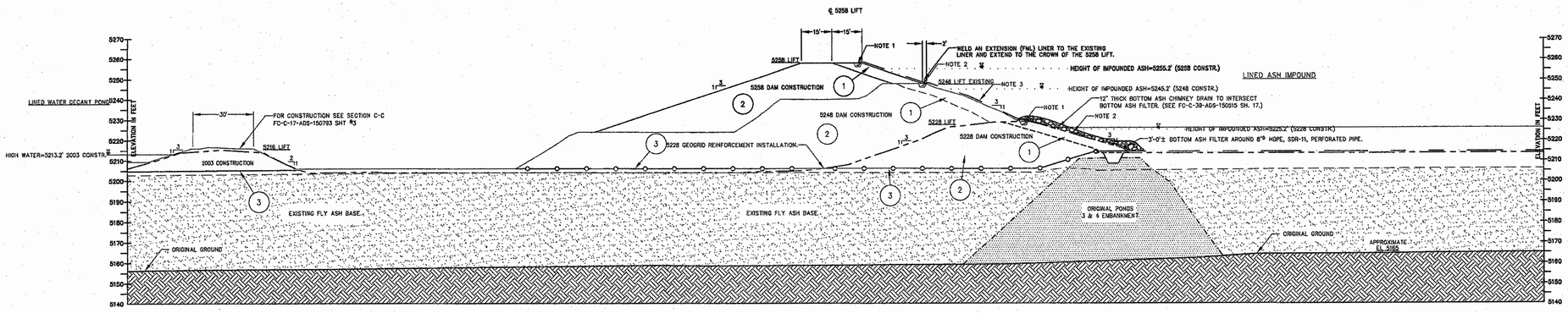
SCALE NOTED DATE 03-11-08

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL ENGINEERING SUPERVISOR	FAC-90057
CHD MD		
EXD BRC		
RVWD		

UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	16	ADS	156687	2

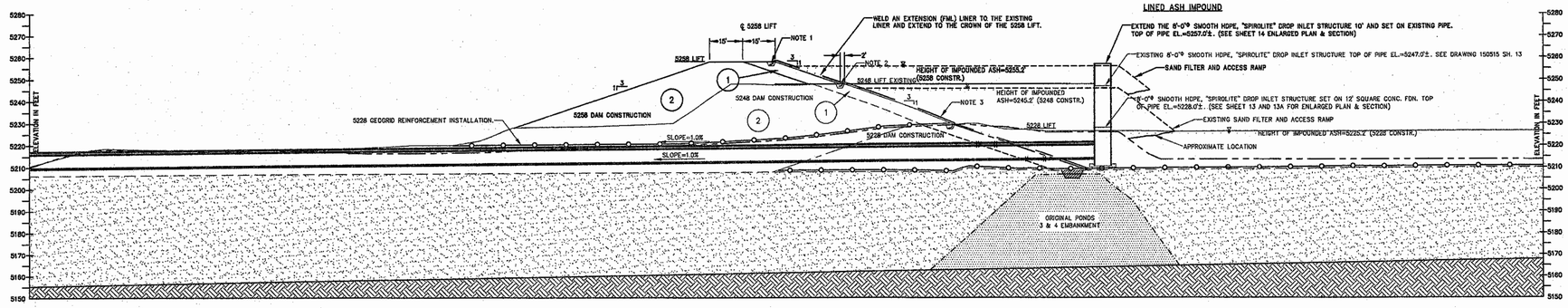
DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civil\

EXHIBIT 1



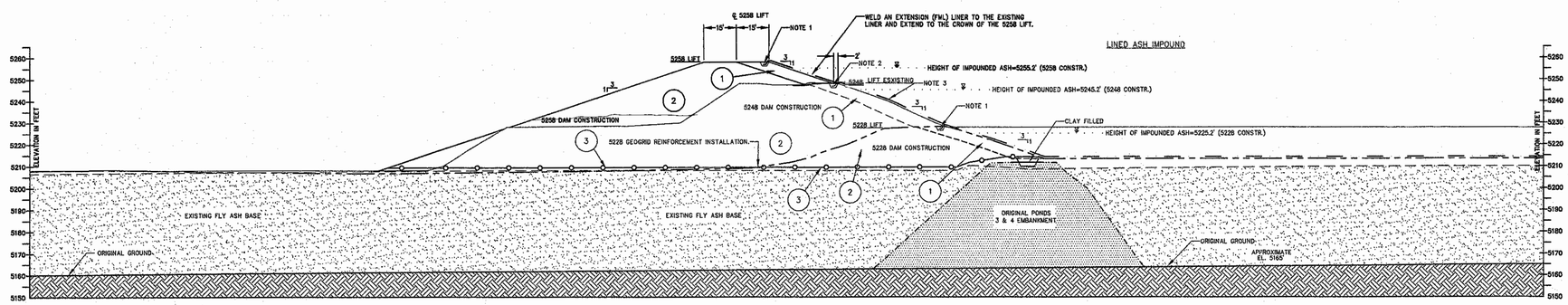
SECTION (A/2) (A/2) SOUTHWEST SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'



SECTION (B/2) (B/2) WEST SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'



SECTION (C/2) (C/2) HORTHWEST SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'

GRAPHIC SCALE

30 0 30 60

(IN FEET)
1 inch = 30 ft.

NOTES

1. ANCHOR TRENCH FOR GEOSYNTHETIC (FML) LINER. (4) SEE 156868 SH.2 DETAIL
2. WORK BENCH FOR WELDING GEOSYNTHETIC (FML) LINER. (5) SEE 156868 SH.2 DETAIL
3. 1-LAYER OF GEOSYNTHETIC (FML) LINER ON THE UPSTREAM FACE OF LINED ASH IMPOUNDMENT. REFERENCE DRAWING FC-C-39-ADS-152408, SH. 4.

NEW DAM EMBANKMENT MATERIALS

1. COMPACTED CLAY/SOIL FILL IN ACCORDANCE WITH THE SPECIFICATIONS.
2. COMPACTED BOTTOM ASH
3. SUB GRADE PREPARATION: GEOGRID REINFORCEMENT-BOTTOM ASH OR CLAY AS SPECIFIED. SEE SECTION (L/7)

LEGEND

- ORIGINAL PONDS 3 & 4 EMBANKMENT
- EXISTING BOTTOM ASH & CONTINUOUS SHALE EMBANKMENT
- EXISTING FLY ASH BASE
- ORIGINAL GROUND SURFACE
- 5258 LIFT
- 2006 TOPO
- 2004 TOPO
- 2001 TOPO
- OLD POND EMBANKMENT
- GEOGRID

REFERENCE DRAWINGS:

SEE DWG 156868 SHEET 1 FOR LINER DETAILS AND LADDER DETAILS

SEE DWG 156868 SHEET 2 FOR BALLAST, WORK BENCH AND KEY TRENCH DETAILS

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

FOR CONSTRUCTION

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
SECTIONS

APS

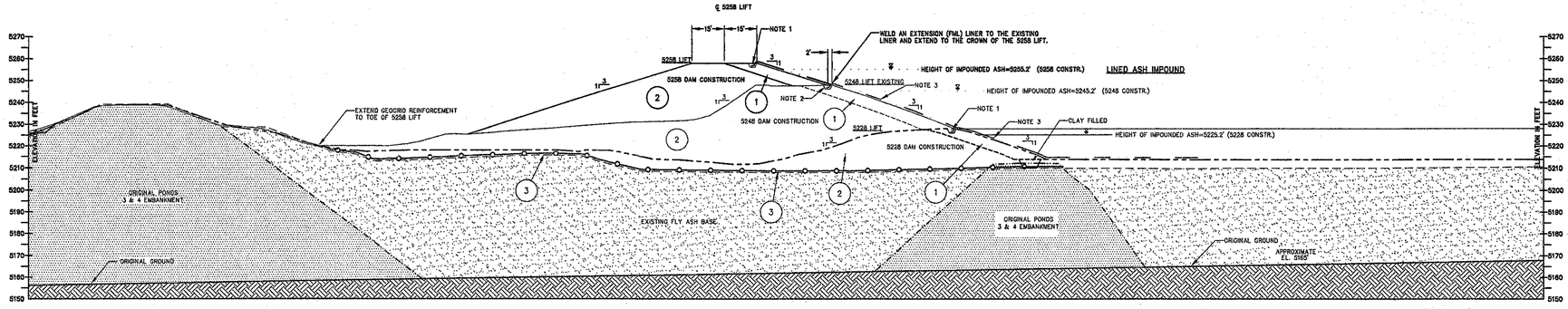
SCALE NOTED DATE 03-11-08

DWN GRK/SMS	APPROVED JOHN D. MITCHELL ENGINEERING SUPERVISOR	W A FAC-90057
CHD MD		
EXD BRC		
RVWD		

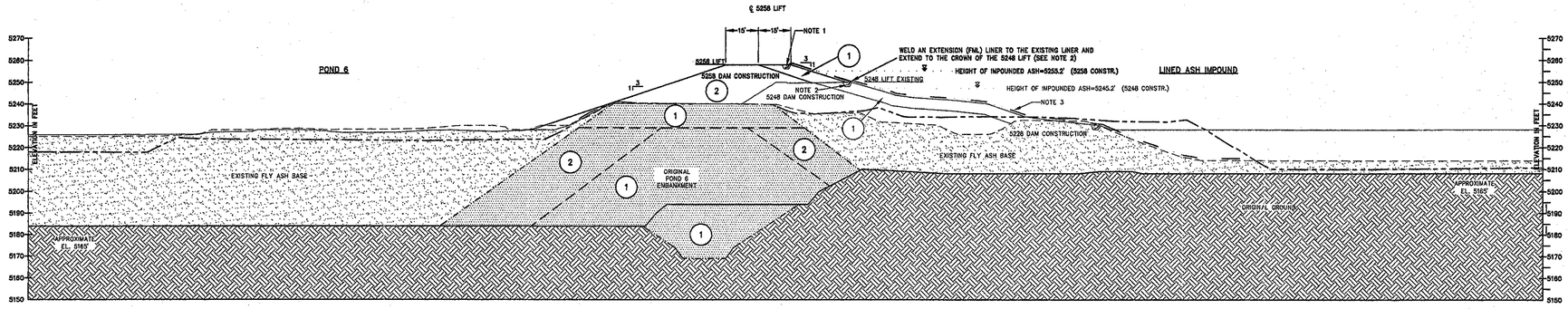
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	65	ADS	156687	4

DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civil\

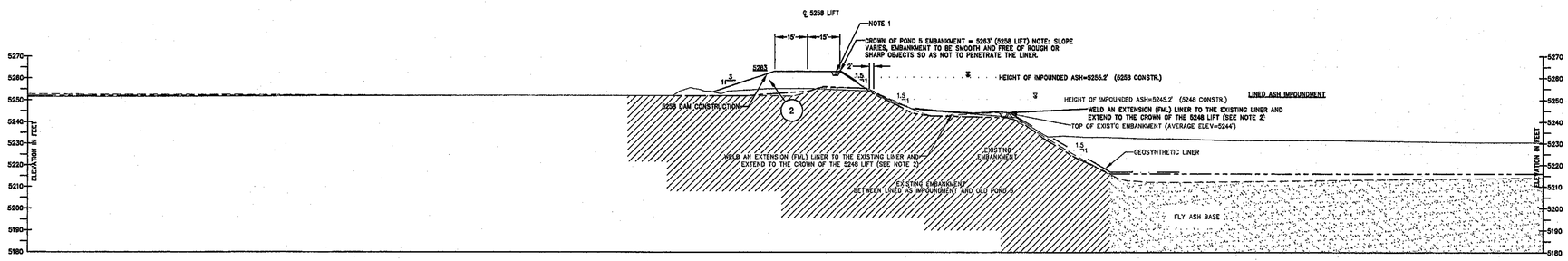
EXHIBIT 2



SECTION D/2 D/2 NORHTWEST SIDE OF POND
HORZ: 1"=30'
VERT: 1"=30'



SECTION E/2 E/2 NORHTWEST SIDE OF POND
HORZ: 1"=30'
VERT: 1"=30'



SECTION F/2 F/2 NORTH SIDE OF POND
HORZ: 1"=30'
VERT: 1"=30'

GRAPHIC SCALE
30 0 30 60
(IN FEET)
1 inch = 30 ft.

NOTES

1. ANCHOR TRENCH FOR GEOSYNTHETIC (FML) LINER. SEE DETAIL 4 / 156868 SH.2
2. WORK BENCH FOR WELDING GEOSYNTHETIC (FML) LINER. SEE DETAIL 5 / 156868 SH.2
3. 1-LAYER OF GEOSYNTHETIC (FML) LINER ON THE UPSTREAM FACE OF LINED ASH IMPOUNDMENT. REFERENCE DRAWING FC-C-39-ADS-152408, SH. 4.

NEW DAM EMBANKMENT MATERIALS

1. COMPACTED CLAY/SOIL FILL IN ACCORDANCE WITH THE SPECIFICATIONS.
2. COMPACTED BOTTOM ASH
3. SUB GRADE PREPARATION: GEOGRID REINFORCEMENT-BOTTOM ASH OR CLAY AS SPECIFIED. SEE SECTION L/7

LEGEND

- ORIGINAL PONDS 3, 4 AND 6 EMBANKMENT
- EXISTING BOTTOM ASH & CONTINUOUS SHALE EMBANKMENT
- EXISTING FLY ASH BASE
- ORIGINAL GROUND SURFACE
- 5258 LIFT
- 2006 TOPO
- 2004 TOPO
- 2001 TOPO
- OLD POND EMBANKMENT

REFERENCE DRAWINGS:

SEE DWG 156868 SHEET 1 FOR LINER DETAILS AND LADDER DETAILS

SEE DWG 156868 SHEET 2 FOR BALLAST, WORK BENCH AND KEY TRENCH DETAILS

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

FOR CONSTRUCTION

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
SECTIONS

APS

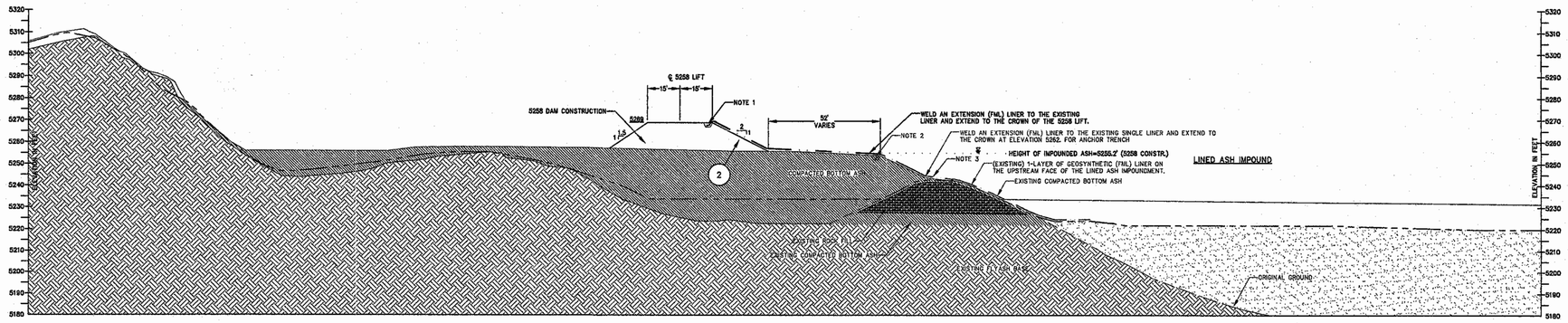
SCALE NOTED DATE 03-11-08

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL ENGINEERING SUPERVISOR	FAC-90057
CHD MD		
EXD BRC		
RVWD		

UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	65	ADS	156687	5

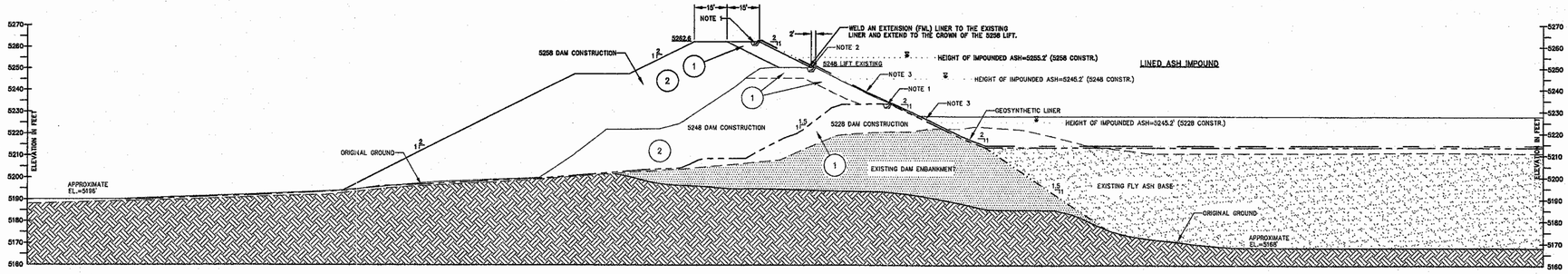
DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civil\

EXHIBIT 3



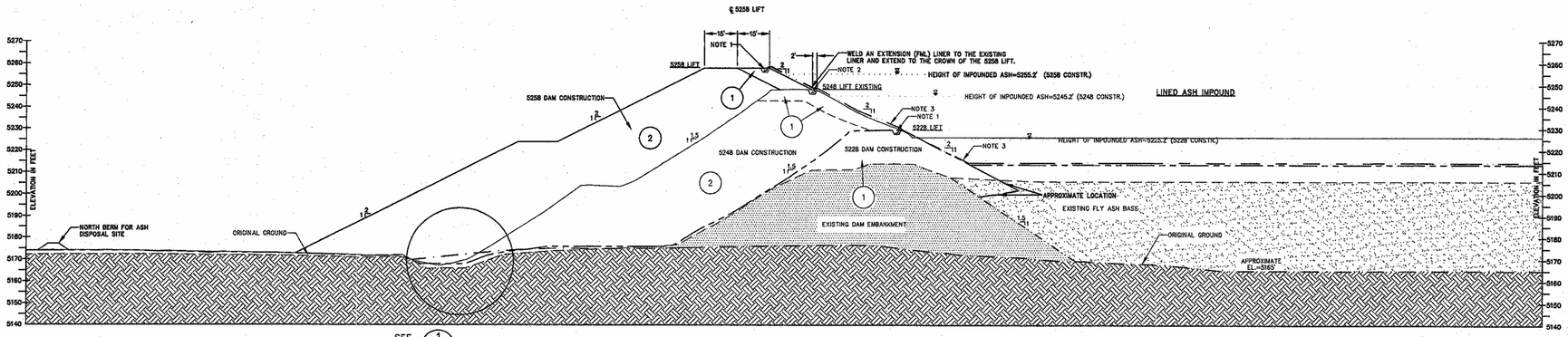
SECTION G/2 G/2 EAST SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'



SECTION H/2 H/2 SOUTH SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'



SECTION J/2 J/2 SOUTH SIDE OF POND

HORZ: 1"=30'
VERT: 1"=30'

GRAPHIC SCALE
30 0 30 60
(IN FEET)
1 inch = 30 ft.

NOTES

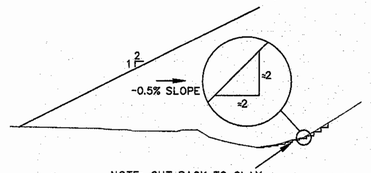
1. ANCHOR TRENCH FOR GEOSYNTHETIC (FML) LINER. SEE 4/156868 SH.2 DETAIL
2. WORK BENCH FOR WELDING GEOSYNTHETIC (FML) LINER. SEE 5/156868 SH.2 DETAIL
3. 1-LAYER OF GEOSYNTHETIC (FML) LINER ON THE UPSTREAM FACE OF LINED ASH IMPOUNDMENT. REFERENCE DRAWING FC-C-39-ADS-152408, SH. 4.

NEW DAM EMBANKMENT MATERIALS

1. COMPACTED CLAY/SOIL FILL IN ACCORDANCE WITH THE SPECIFICATIONS.
2. COMPACTED BOTTOM ASH
3. SUB GRADE PREPARATION: GEOGRID REINFORCEMENT-BOTTOM ASH OR CLAY AS SPECIFIED. SEE SECTION L/7

LEGEND

- ORIGINAL DAM EMBANKMENT
- EXISTING BOTTOM ASH & CONTINUOUS SHALE EMBANKMENT
- EXISTING FLY ASH BASE
- ORIGINAL GROUND SURFACE
- BACK LINER TIE AREA COMPACTED BOTTOM ASH
- ROCK FILL 5228 CONSTRUCTION
- 5258 LIFT
- 2006 TOPO
- 2004 TOPO
- 2001 TOPO
- OLD POND EMBANKMENT



NOTE: CUT BACK TO CLAY CONSTRUCTION AS APPROVED BY APS REPRESENTATIVE CONSTRUCT NEW EMBANKMENT AND KEY WITH COMPACTED BOTTOM ASH AS IN CIVIL STRUCTURAL SPECIFICATION 16.5.10.1

DETAIL 1/2 KEY CUT

SCALE 1"=20'

FOR CONSTRUCTION

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
SECTIONS

APS

SCALE NOTED DATE 03-11-08

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL ENGINEERING SUPERVISOR	FAC-90057
CHD MD		
EXD BRC		
RVWD		

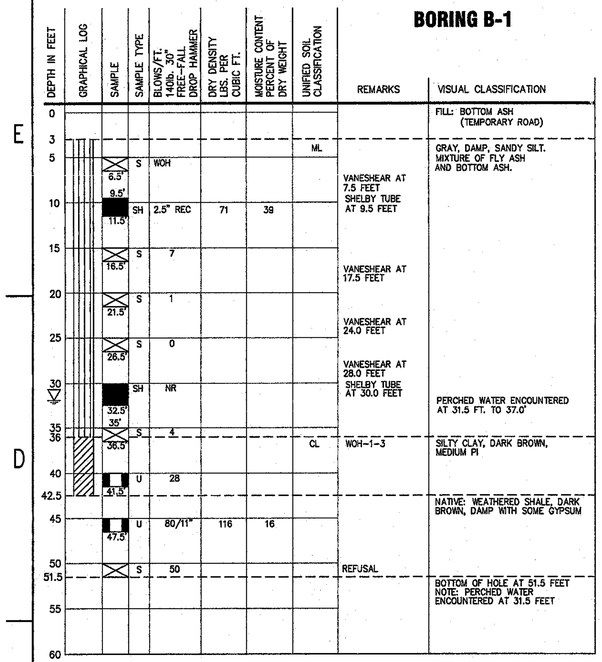
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	65	ADS	156687	6

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civ

EXHIBIT 4

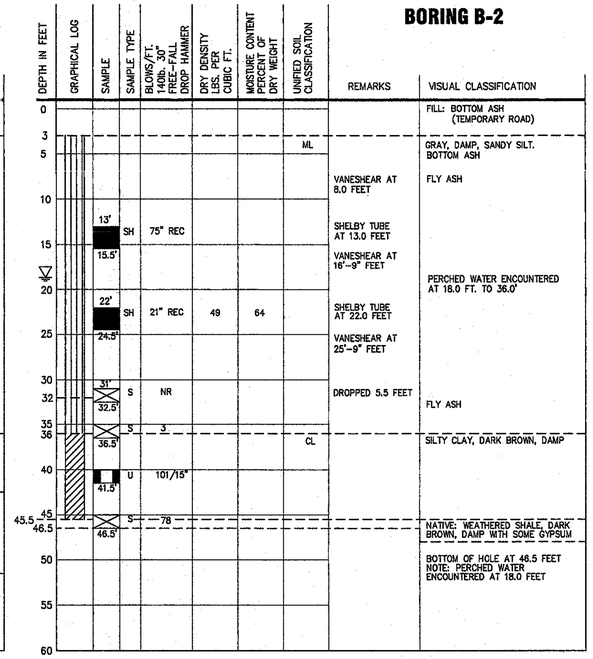
BORING B-1



GROUNDWATER DEPTH = 31.5'

SAMPLE TYPE
A=AUGER CUTTINGS; NR=NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

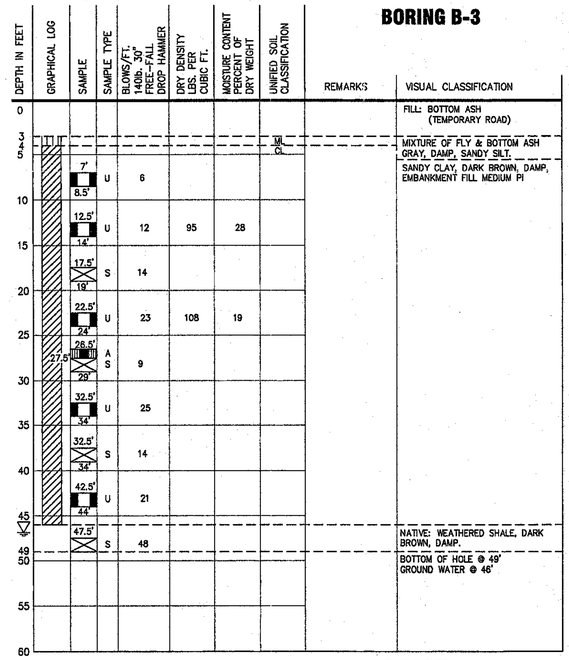
BORING B-2



GROUNDWATER DEPTH = 18.0'

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-3

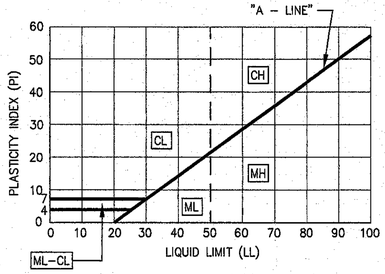


GROUNDWATER DEPTH = 46.0'

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

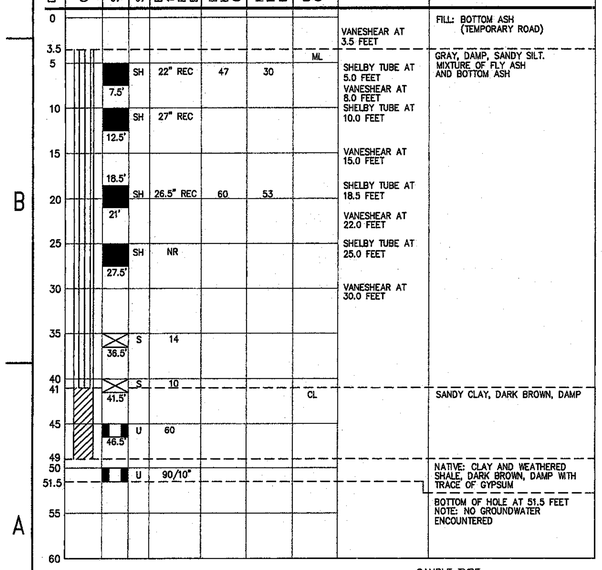
MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS, (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS. GRAVEL-SAND MIXTURE. LITTLE OR NO FINES.
				GP	POORLY GRADED GRAVELS. GRAVEL-SAND MIXTURE. LITTLE OR NO FINES.
		GRAVELS WITH FINES. (APPRECIABLE AMOUNT OF FINES.)		GM	SILTY GRAVELS. GRAVEL-SAND-SILT MIXTURES.
				GC	CLAYEY GRAVELS. GRAVEL-CLAY-SAND MIXTURE.
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELY-SANDS, LITTLE OR NO FINES.
				SP	POORLY GRADED SANDS. GRAVELY-SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES. (APPRECIABLE AMOUNT OF FINES.)		SM	SILTY SANDS. SAND-SILT MIXTURE.
				SC	CLAYEY SANDS. SAND-CLAY MIXTURES.
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY. GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
				OL	ORGANIC SILTS AND ORGANIC SILTY-CLAYS OF LOW PLASTICITY.
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.
				CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS.
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS, ORGANIC SILTS.
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS.

UNIFIED SOIL CLASSIFICATION SYSTEM



PLASTICITY CHART

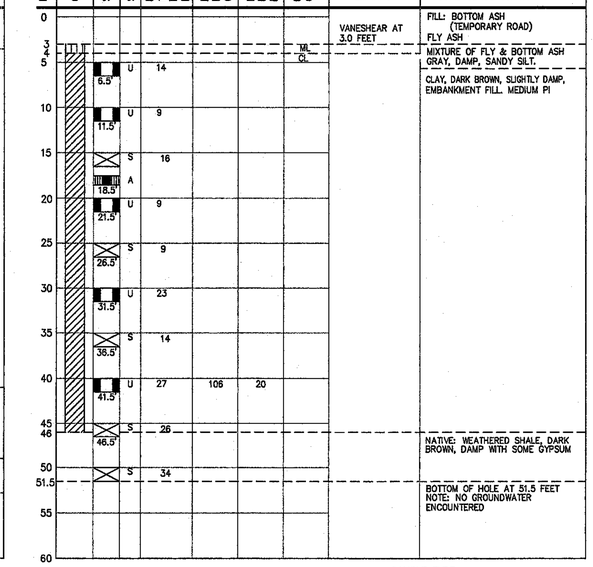
BORING B-4



GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

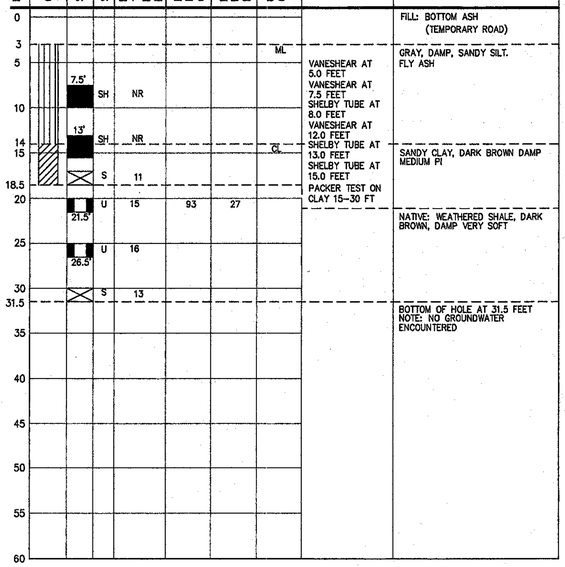
BORING B-5



GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

BORING B-6



GROUNDWATER DEPTH = N/A

SAMPLE TYPE
A=AUGER CUTTINGS; NO RECOVERY
S=2" O.D. 1.38" I.D. TUBE SAMPLE
U=3" O.D. 2.42 I.D. TUBE SAMPLE
SH=3" O.D. THIN WALLED SHELBY TUBE

FOR CONSTRUCTION

NOTE
BORING LOCATIONS SHOWN ON DRAWING NO. 156687 SHEET #3

BYRON R. COMPAU NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
SOIL BORING LOGS

APS

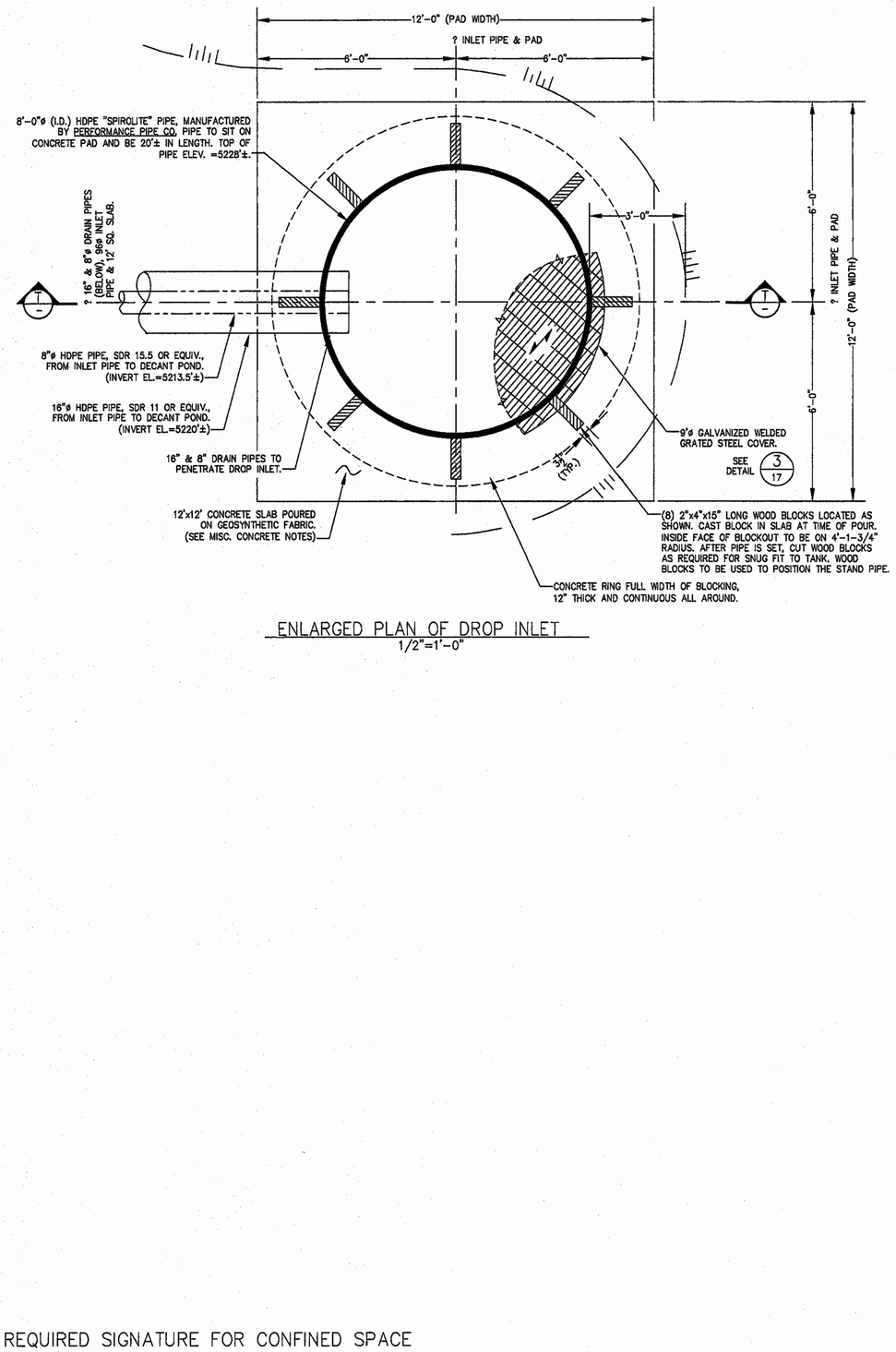
SCALE NONE — DATE 03-05-08

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL ENGINEERING SUPERVISOR	FAC-90057
CHD MD		
EXD BRC		
RVWD		

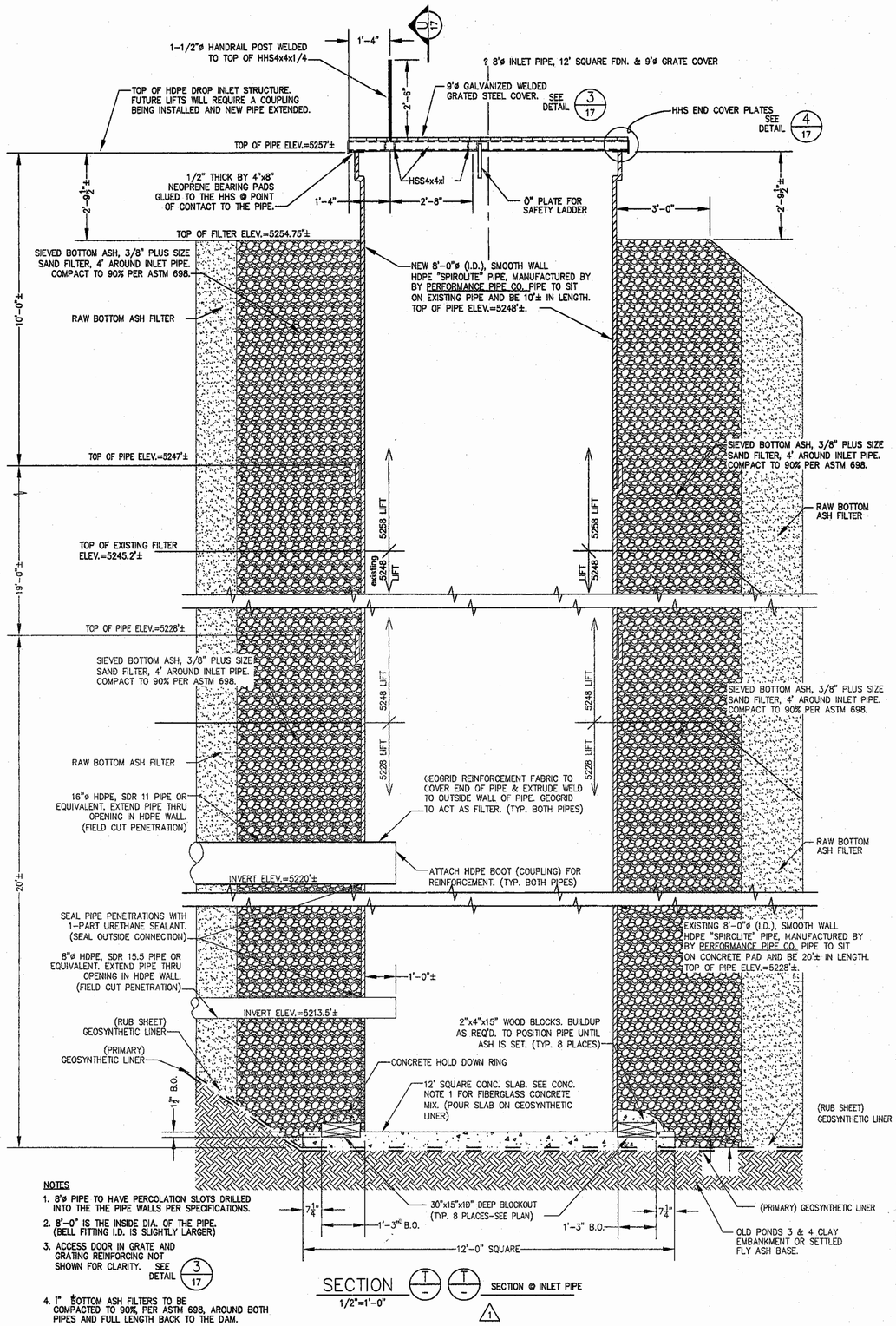
UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	39	ADS	156687	10

DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civil\(LAND DEVELOPME

EXHIBIT 5



ENLARGED PLAN OF DROP INLET
1/2"=1'-0"



SECTION
1/2"=1'-0"

SECTION @ INLET PIPE
1

NOTES
1. 8'ø PIPE TO HAVE PERCOLATION SLOTS DRILLED INTO THE THE PIPE WALLS PER SPECIFICATIONS.
2. 8'-0" IS THE INSIDE DIA. OF THE PIPE. (BELL FITTING I.D. IS SLIGHTLY LARGER)
3. ACCESS DOOR IN GRATE AND GRATING REINFORCING NOT SHOWN FOR CLARITY. SEE DETAIL 3/17
4. 1" BOTTOM ASH FILTERS TO BE COMPACTED TO 90% PER ASTM 698, AROUND BOTH PIPES AND FULL LENGTH BACK TO THE DAM.

MISC. CONCRETE NOTES:

1. CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI. SLUMP SHALL BE 4 INCHES ±1 INCH. CLASS F FLY ASH IS REQUIRED AND SHALL REPLACE A MINIMUM OF 25% CEMENT CONTENT BY WEIGHT. MINIMUM CEMENT AND FLY ASH CONTENT SHALL THEN BE 470 LB PER CUBIC YARD. MIX DESIGN SHALL BE SUBMITTED FOR REVIEW A MINIMUM OF TWO WEEKS PRIOR TO PLACEMENT OF CONCRETE.
2" LONG "FIBERMESH", SYNTHETIC FIBERGLAS FIBERS FOR CONCRETE REINFORCEMENT, SHALL BE ADDED TO THE MIX AT 1.5lbs PER CUBIC YARD. FIBERS CAN BE INTRODUCED WITH THE AGGREGATES OR AFTER ALL INGREDIENTS HAVE BEEN BLENDED OR MIXED.

2. ALL CONCRETE MATERIALS AND INSTALLATION SHALL CONFORM TO APS FOSSIL GENERATION STANDARD CS04-000010.

REQUIRED SIGNATURE FOR CONFINED SPACE

SAFETY REPRESENTATIVE _____ DATE _____

BYRON R. CONRAD NEW MEXICO 13248 REGISTERED PROFESSIONAL ENGINEER

FOR CONSTRUCTION

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
NEW 10' DROP INLET PIPE PLAN & SECTION

APS

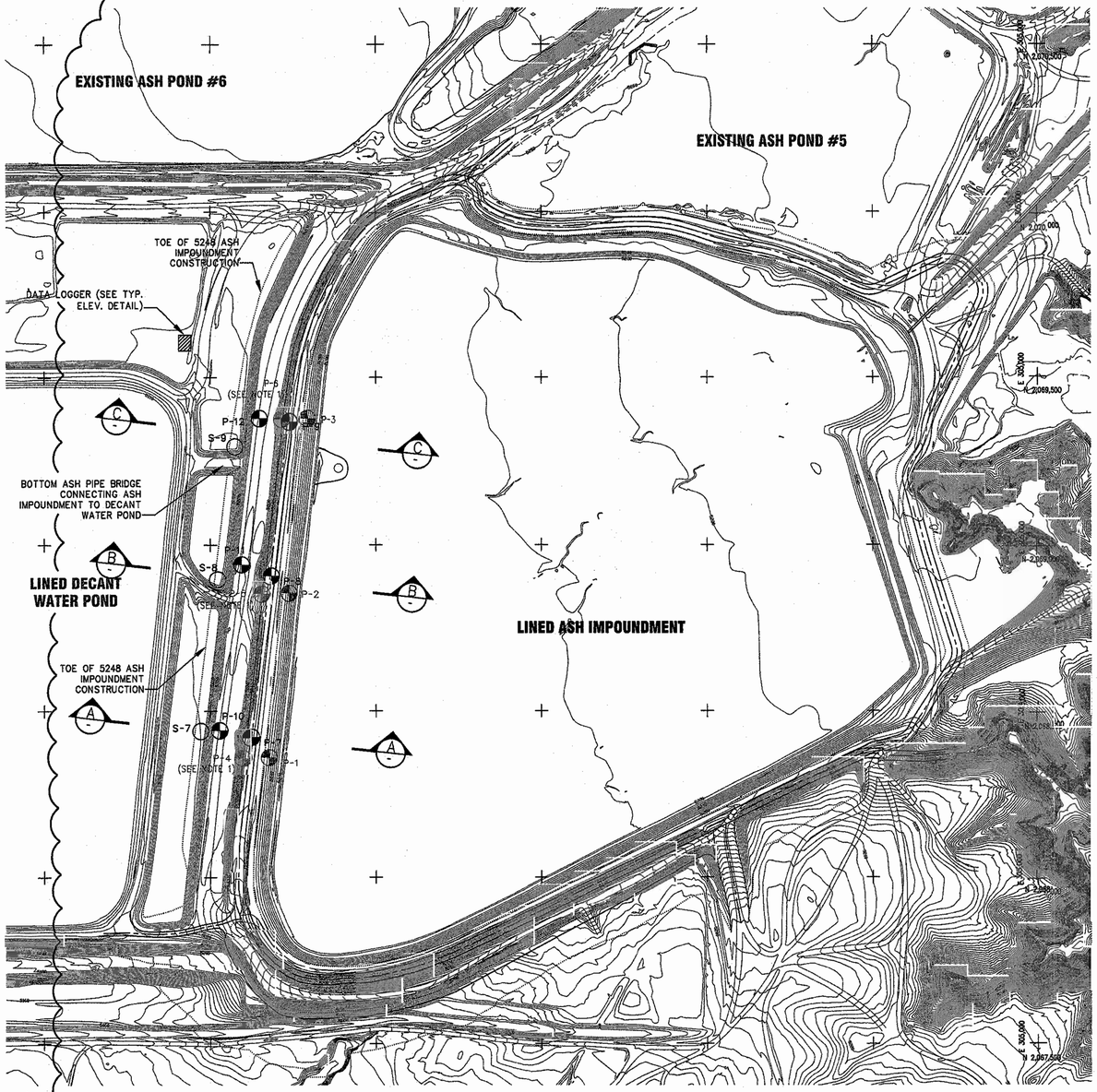
SCALE NOTED DATE 10-29-07

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL ENGINEERING SUPERVISOR	FAC-90057
CHD MD		
EXD BRC		
RVWD		

UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	65	ADS	156687	14

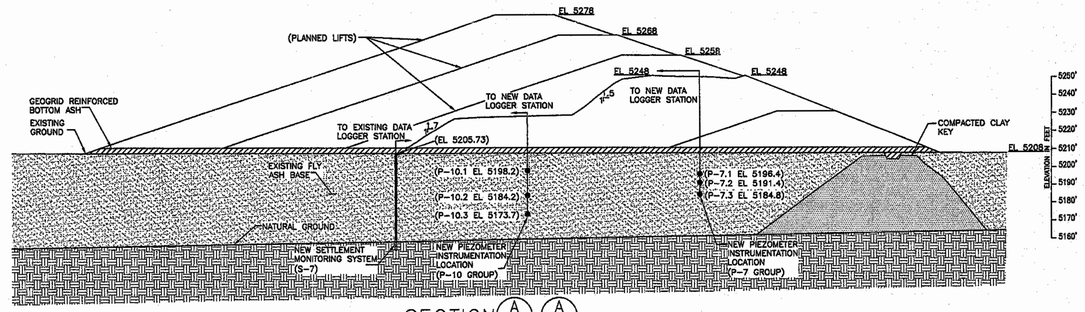
DRAWING: H:\COMMON_ACTIVE\FC\F123\FAC90057 U1-3 5258 Lift Lined Ash Impoundment\D10. Dwgs\Civil\(LAND DEVELOPME

EXHIBIT 6

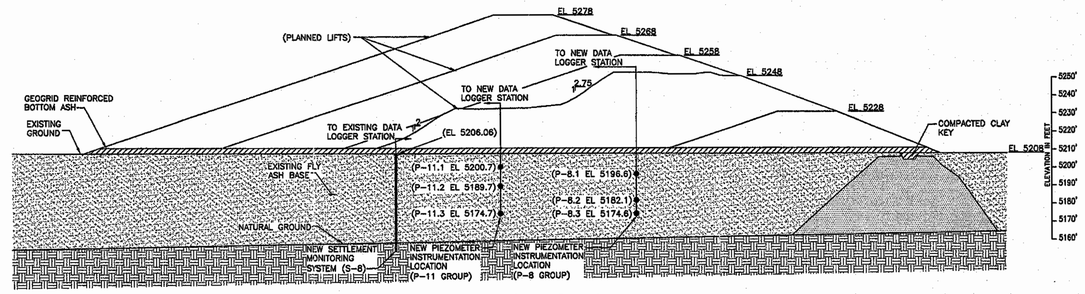


NOTES:

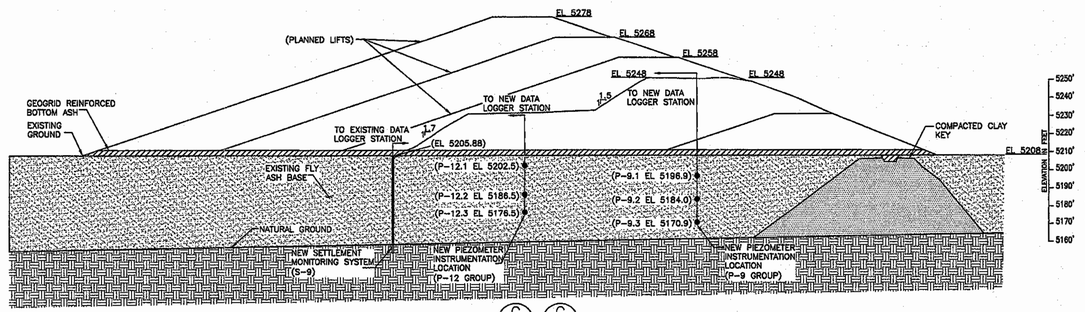
1. VIBRATING WIRE PIEZOMETERS P7, P8, P9, P10, P11, P12 ELEVATIONS HERE PROVIDED BY URS CORPORATION.



SECTION A A PIEZOMETER CROSS SECTION
SCALE: 1"=40'



SECTION B B PIEZOMETER CROSS SECTION
SCALE: 1"=40'



SECTION C C PIEZOMETER CROSS SECTION
SCALE: 1"=40'

NORTH

VIBRATING WIRE PIEZOMETER CLUSTER & SETTLING PLATE LOCATIONS

1"=200'
CONTOUR INTERVAL=2'

GRAPHIC SCALE
200 0 200 400
(IN FEET)
1 inch = 200 ft.

PIEZOMETER INSTALLATION SPECIFICATIONS

VIBRATING WIRE PIEZOMETERS ARE RECOMMENDED AT 500' CENTERS ALONG THE CENTERLINE OF THE EMBANKMENT. AT EACH LOCATION THE PIEZOMETER SHOULD BE CAPABLE OF MEASURING THE EXCESS PORE WATER PRESSURE AT APPROXIMATELY 5 TO 12 FEET BELOW THE FLY ASH SURFACE, 16 TO 26 FEET AND 23 TO 37 FEET. SETTLEMENT PLATES WILL BE INSTALLED TO MONITOR SETTLEMENT DURING CONSTRUCTION AND TO ADJUST FILL REQUIREMENTS APPROPRIATELY. THE SETTLEMENT PLATES WILL BE IN CLOSE PROXIMITY TO THE PIEZOMETERS.

PIEZOMETER & SETTLING PLAT LOCATIONS

INSTRUMENT NO.	NORTHING	EASTING
P-7	2068421	302624
P-8	2068907	302683
P-9	2069369	302740
P-10	2068441	302527
P-11	2068941	302593
P-12	2069376	302647
S-7	2068439	302470
S-8	2068896	302521
S-9	2069293	302573

PIEZOMETER POINTS
(TIED TO STATE COORDINATES)

LEGEND

- P-7 VIBRATING WIRE PIEZOMETER GROUP
- S-7 SETTLING PLATE LOCATIONS
- EXISTING FLY ASH BASE
- ORIGINAL ENBANKMENT
- NATURAL GROUND

REFERENCE:

1. EDOC ITEM # 1219960063 FOR ELECTRONIC PIEZOMETER READINGS

1

BYRON R. CONRAD
NEW MEXICO
13248
REGISTERED PROFESSIONAL ENGINEER

FOR CONSTRUCTION

NO.	DATE	REVISION	DWN	CHD	EXD	RVWD	APVD	W.A.
1	09-05-08	ADD SETTLING PLATES & SEC. C	SMS	MLD	BRC		JDM	FAC90057

FOUR CORNERS COMMON
ASH HANDLING SYSTEM
LINED ASH IMPOUNDMENT 5258 LIFT
NEW PIEZOMETER & SETTLING PLATE LOCATIONS

APS

SCALE NOTED DATE 03-07-08

DWN	APPROVED	W A
GRK/SMS	JOHN D. MITCHELL	
CHD	ENGINEERING SUPERVISOR	FAC-90057
MD		
EXD		
BRC		
RVWD		

UNIT	DISC	TYPE	SYS	NUMBER	SHEET
FC	C	39	ADS	156687	13

DRAWING: P:\Active\FC-F123\1279\10. Dwgs\Civil\(LAND DEVELOPMENT STRUCTURE)\FC-C-39-ADS-156687-13.dwg FC-C-

EXHIBIT 7

Appendix A

Instrumentation

LINED WATER IMPOUNDMENT – 2nd Half Reporting Period (July – December 2008)

Tube No.	Sta. No. Reference	North	East	Elevation/ Depth	July, 08	Aug., 08	Sept., 08	Oct., 08	Nov., 08	Dec., 08
P18*	7+77.0	2,067,835.4	301,490.2	5216.48/65.25'	DRY	DRY	DRY	DRY	DRY	DRY
P19*	12+12.0	2,067,966.3	301,117.5	5216.02/	DRY	DRY	DRY	DRY	**	DRY
P20*	17+00.0	2,068,446.9	301,049.8	5216.10/88.5'	DRY	DRY	DRY	DRY	DRY	DRY
P21*	22+46.0	2,086,961.6	301,126.7	5216.28/	DRY	DRY	DRY	DRY	DRY ~ 82.85	DRY
P22*	26+08.0	2,068,812.0	301,196.5	5217.07/67.00	DRY	DRY	DRY	DRY	DRY	DRY

**** This readings was not taken because it was buried.**

* **P21 – It is believed the piezometer is bottomed out even though moisture was detected.**

Fig A-1 LDWI Piezometer Water Elevations

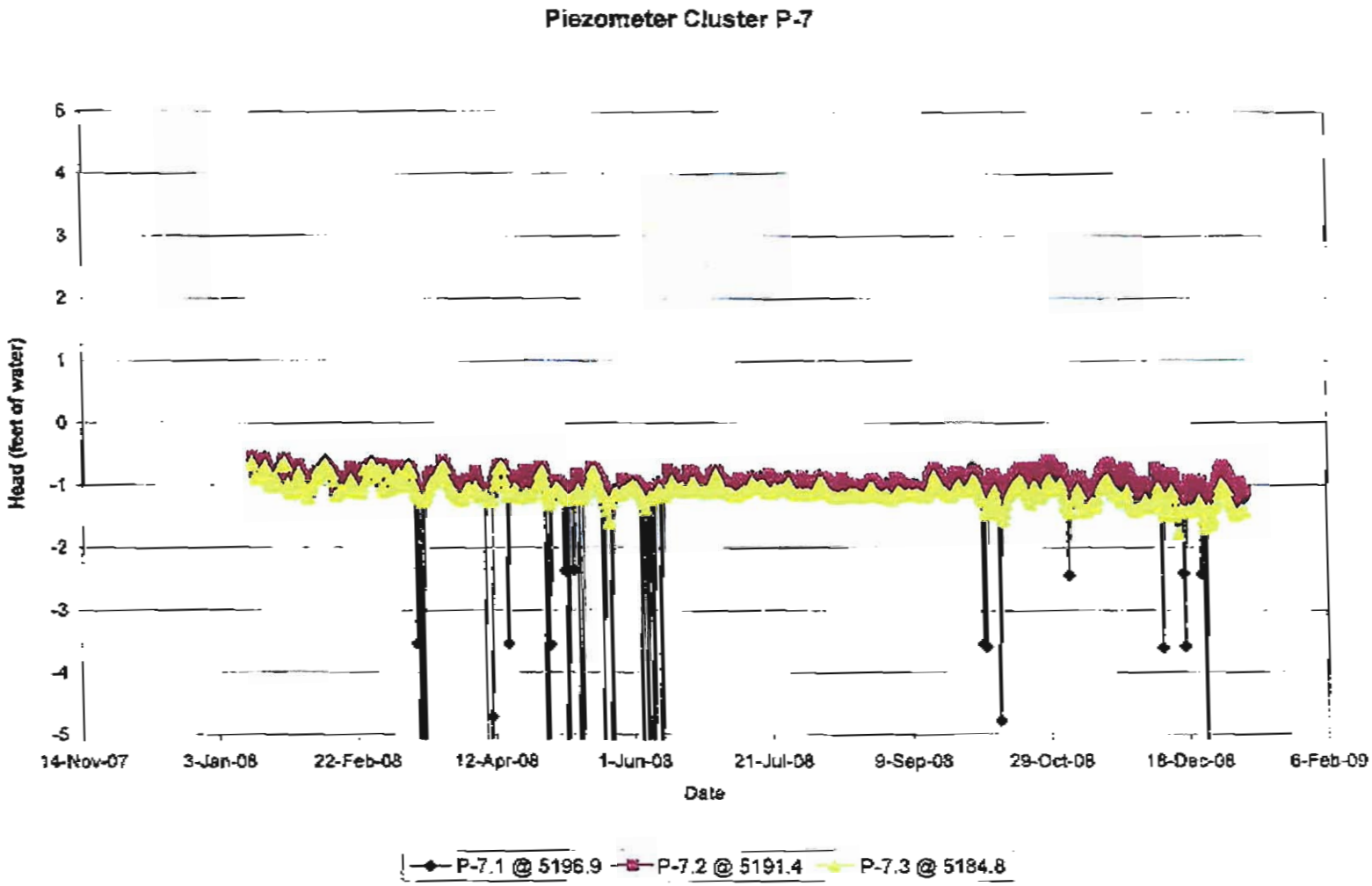


Fig A-2 LAI Piezometer water Elevations (Cluster P-7)

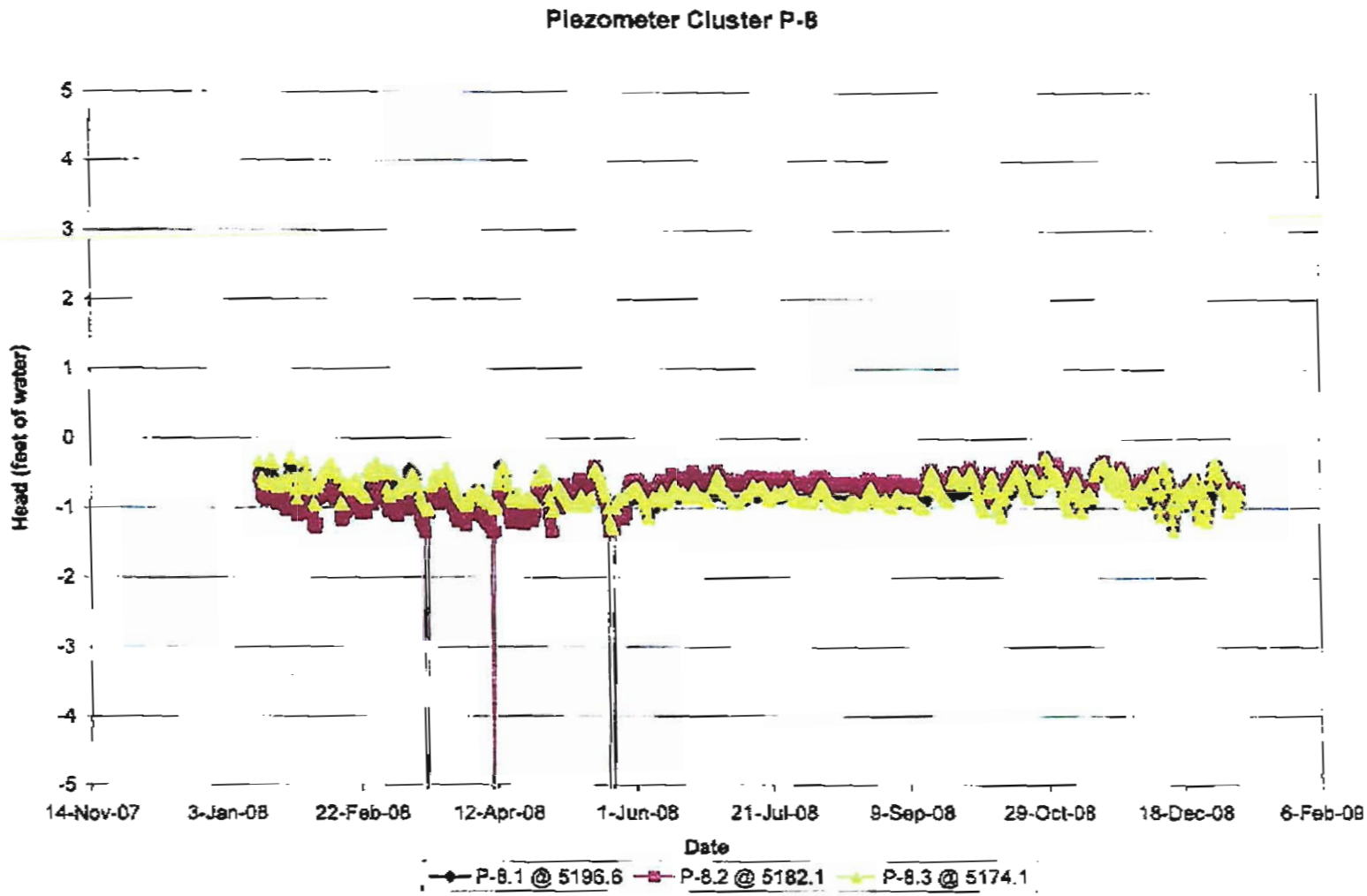


Fig A-3 LAI Piezometer Water Elevations (Cluster P-8)

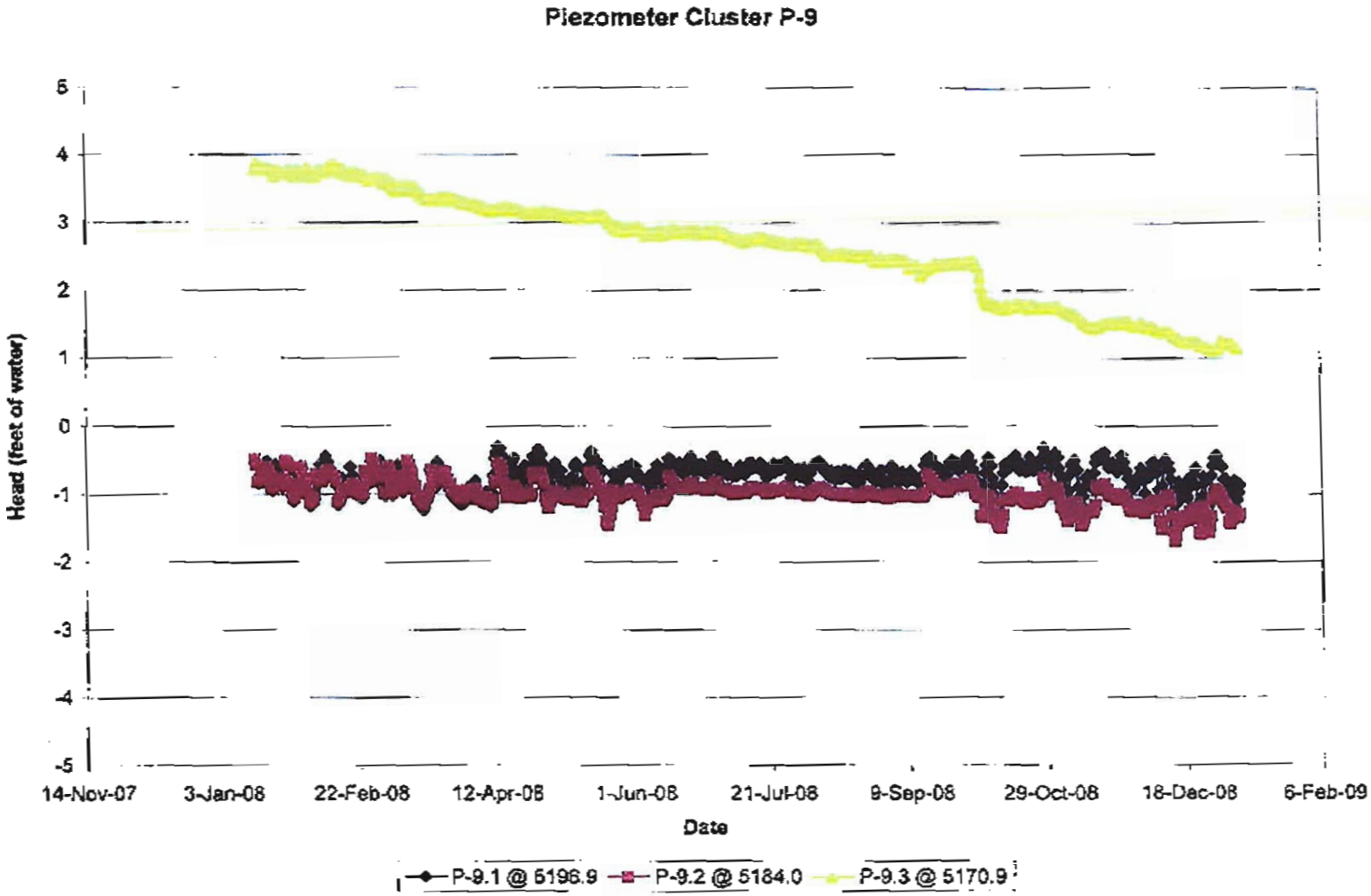


Fig A-4 LAI Piezometer Water Elevations (Cluster P-9)

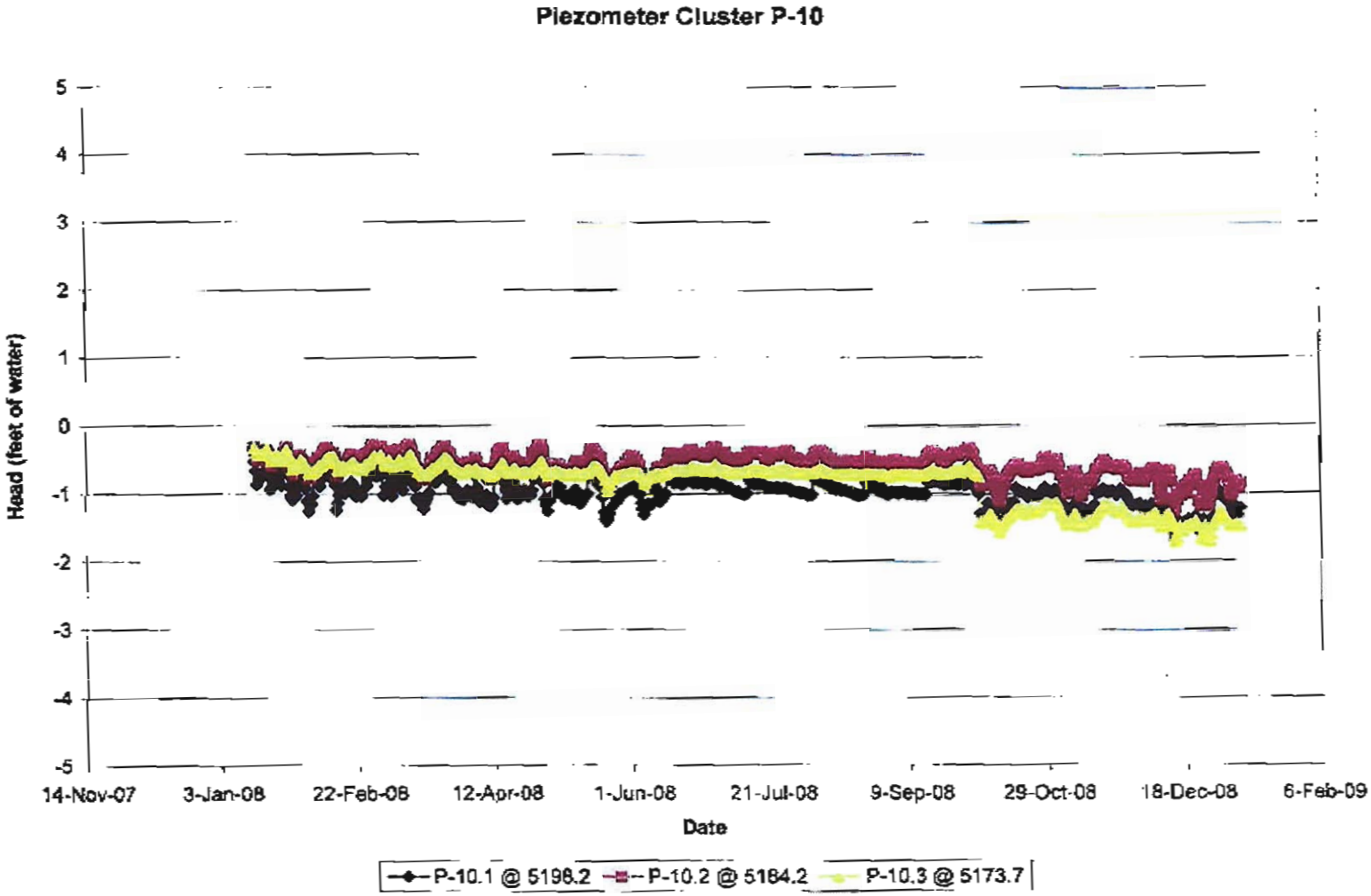


Fig A-5 LAI Piezometer Water Elevations (Cluster P-10)

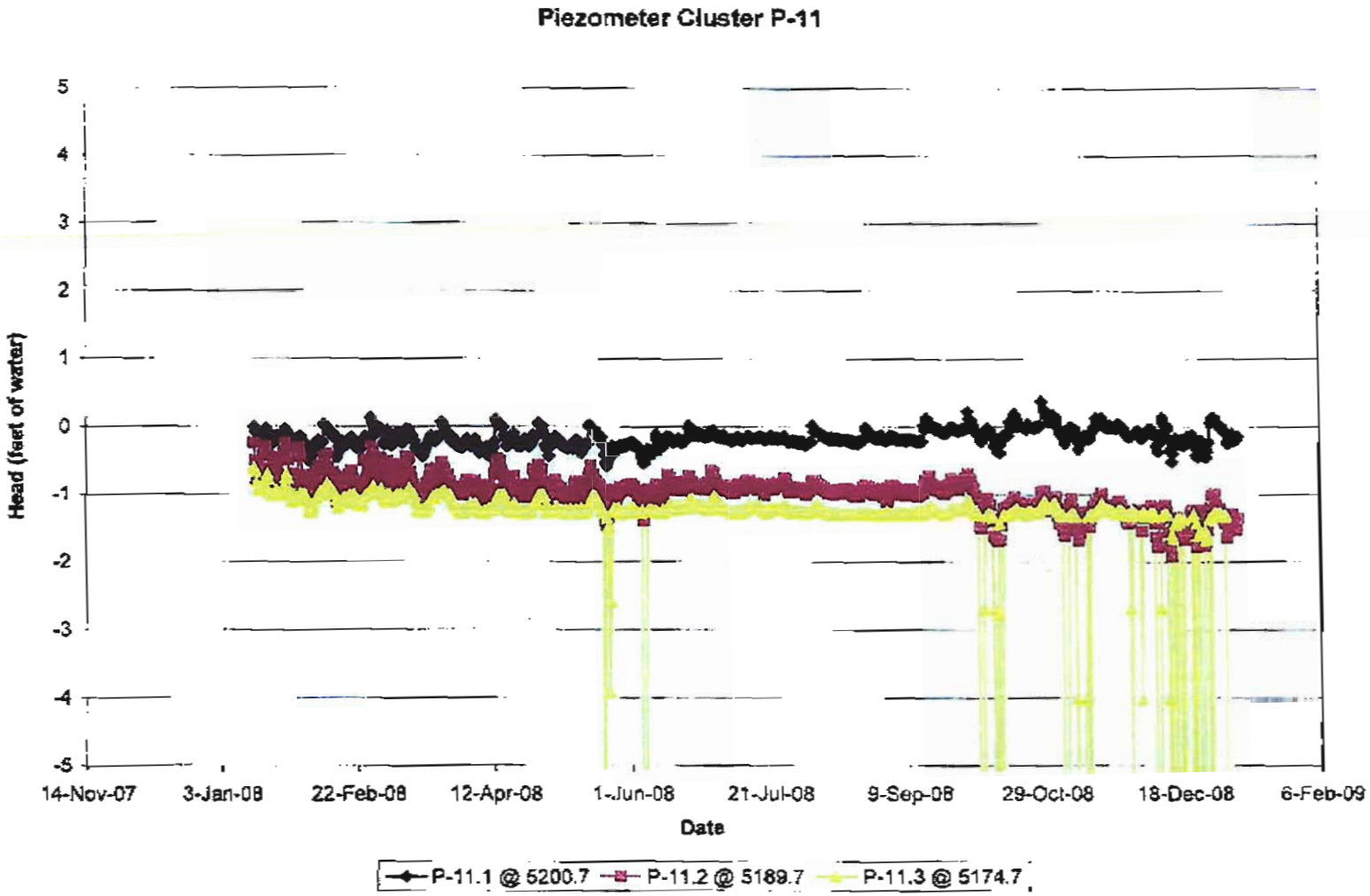


Fig A-6 LAI Piezometer Water Elevations (Cluster P-12)

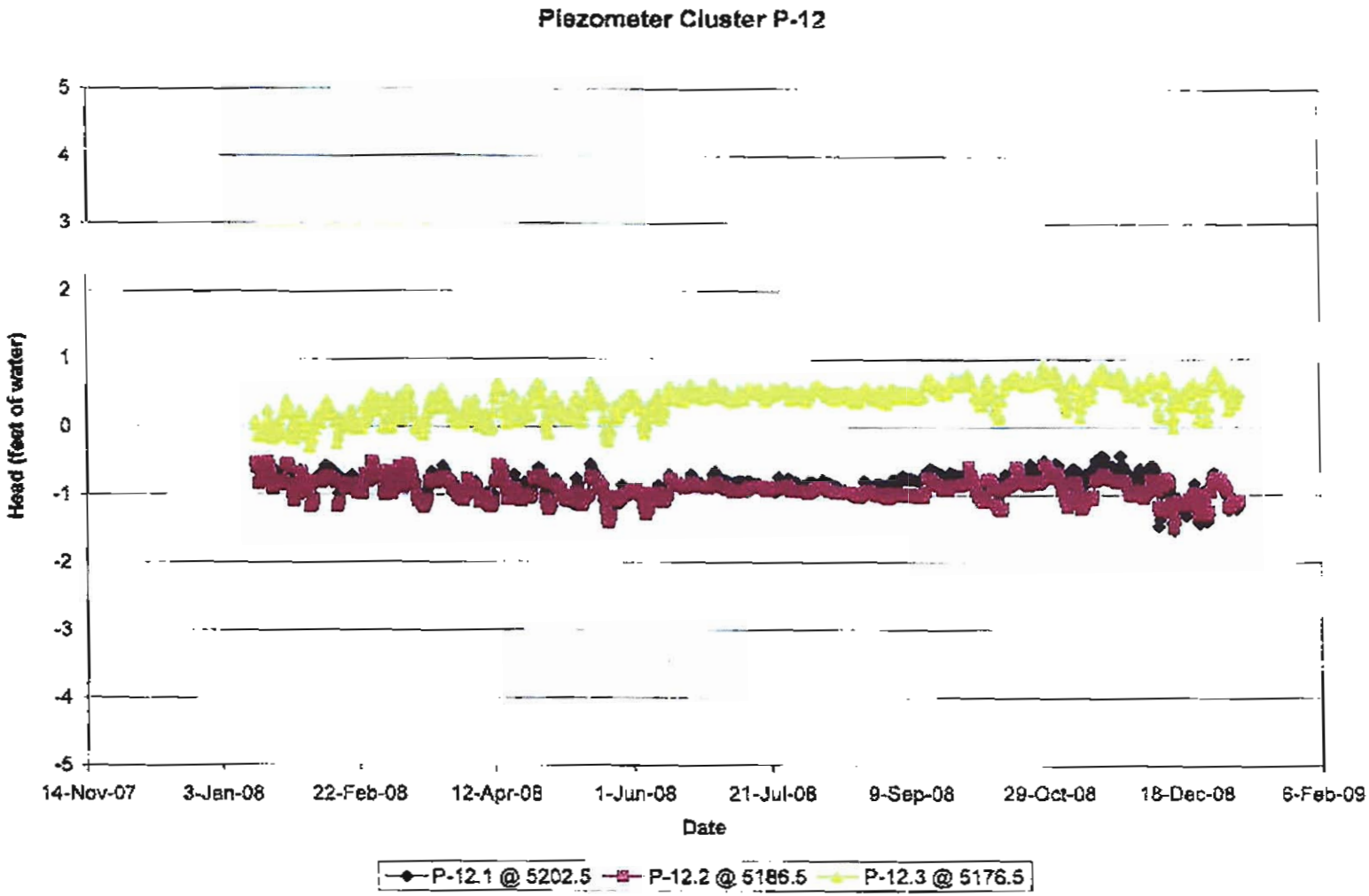
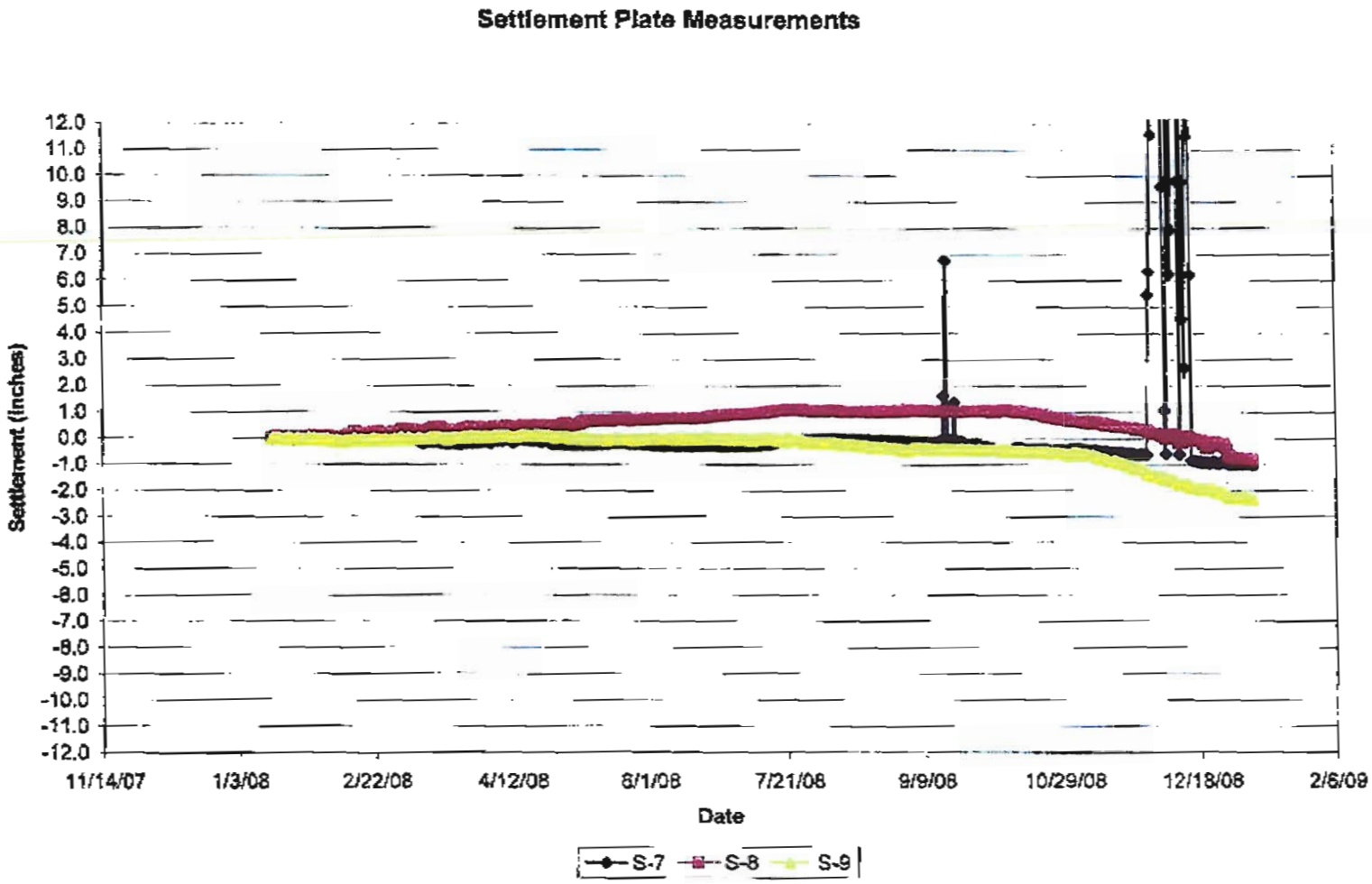


Fig A-7 LAI Piezometer Water Elevations (Cluster P-9)



\\apec.com\apsfiles\Fossil\U7610\Projects\Active\FC-F123\1279\04. Engineering_Construction\4.03 Piezos\2008\FCPP_Piezometer_Data_Charts_2008_(2).xls

Fig A-8 LAI Settlement Plate Measurements

Appendix B

Inspection Checklist

May 20, 2009

...ustion Dam Inspection Checklist Form

US Environmental Protection Agency

Name: APS FOUR CORNERS POWER PLANT Date: MAY 20, 2009

...nit Name: LINED ASH IMPOUNDMENT Operator's Name: ARIZONA PUBLIC SERVICE CO.

Unit I.D.: NM00634 Hazard Potential Classification: High (Significant) Low

Inspector's Name: STEPHEN G. BROWN, GEI CONSULTANTS, INC.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections? 6 Months	✓		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)? 5241	✓		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)? 5217 & 5213.5	✓		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A	✓	Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)? 5248	✓		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?	✓		Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?		✓ N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

4. NO SPILLWAY PROVIDED

1. EVERY 6 MONTHS.

7. CONSTRUCTION IS COMPLETE AT EL. 5248, AS OF THIS ASSESSMENT. CONSTRUCTION HAS BEGUN TO RAISE THE DAM TO EL. 5258.

18 & 17. INTERIOR SLOPES COVERED BY HDPE GEOSYNTHETIC LINER

21. LEAK DETECTION SYSTEM OR UNDERDRAIN NOT PROVIDED.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NM0000019 INSPECTOR STEPHEN G. BROWN
GRI CONSULTANTS, INC.
Date MAY 20, 2009

Impoundment Name LINED ASH IMPOUNDMENT
Impoundment Company ARIZONA PUBLIC SERVICE, FOUR CORNERS, NM.
EPA Region 6
State Agency (Field Office) Addresss N/A

Name of Impoundment LINED ASH IMPOUNDMENT
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ____

	Yes	No
Is impoundment currently under construction?	____	✓
Is water or ccw currently being pumped into the impoundment? CCW BY GRAVITY FLOW	✓	____

IMPOUNDMENT FUNCTION: FLY ASH STORAGE (LIQUID-BORNE)

Nearest Downstream Town : Name SHIPROCK
Distance from the impoundment 13 MILES (APPROX.).
Impoundment Location: LONG -108.5066 LAT 36.6849
Longitude ____ Degrees ____ Minutes ____ Seconds
Latitude ____ Degrees ____ Minutes ____ Seconds
State NM County SAN JUAN.

Does a state agency regulate this impoundment? YES ✓ NO ____

If So Which State Agency? NEW MEXICO OFFICE OF STATE ENGINEER

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

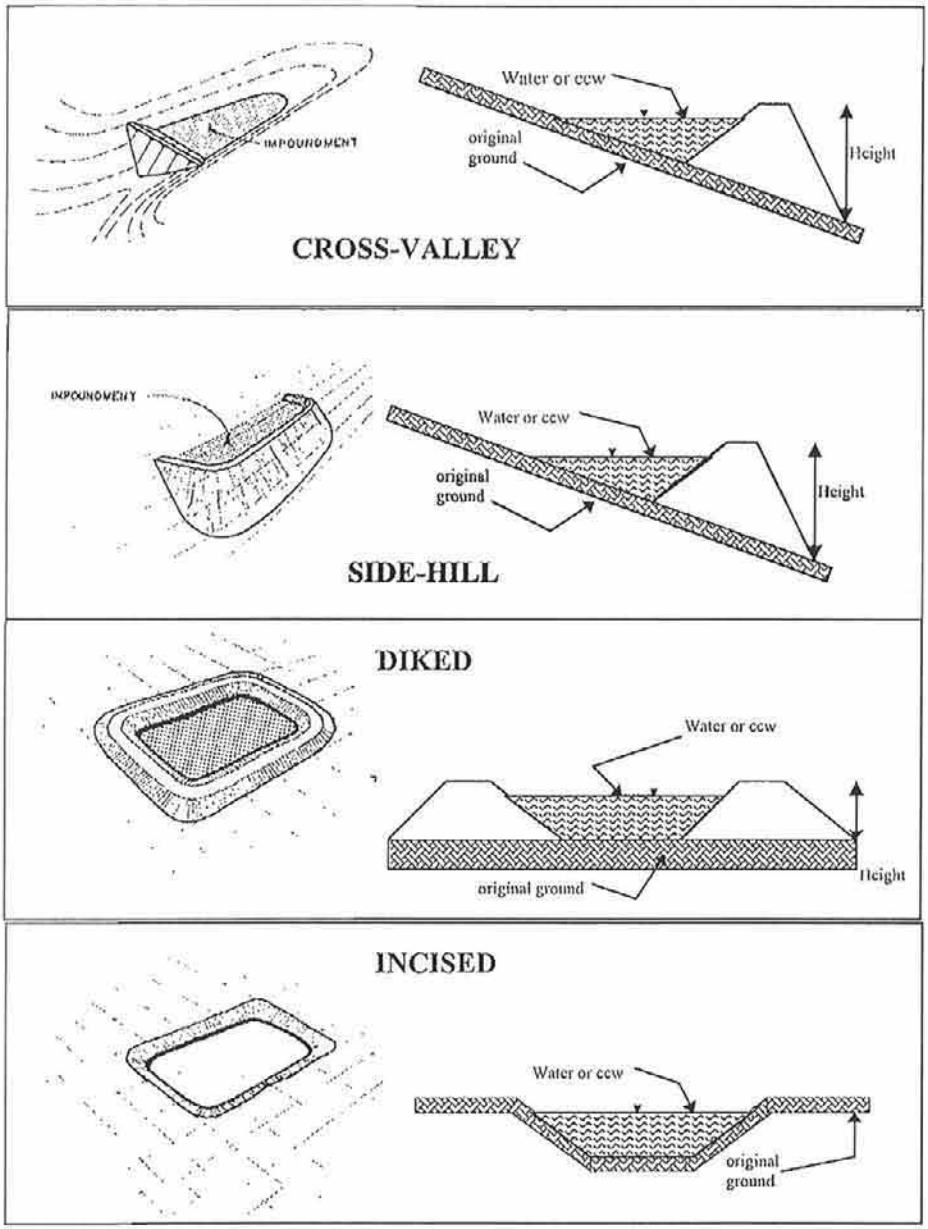
__✓__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

ENVIRONMENTAL DAMAGE ALONG CHACO RIVER DRAINAGE TO THE SAN JUAN RIVER.

CONFIGURATION:



_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 40 feet(1) Embankment Material Bottom Ash w/ Clay Liner
Pool Area 75 acres Liner 15' thick clay + 60 mil HDPE membrane
Current Freeboard 7 feet Liner Permeability clay 1×10^{-2} ft/day; HDPE 1×10^{-10} ft/day

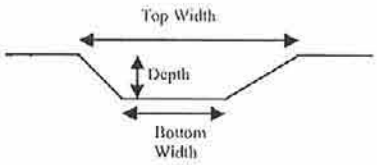
(1) Lined ash impoundment is constructed on top of old ash impoundment #3, which is 43 feet high. Total height is 83 feet.

TYPE OF OUTLET (Mark all that apply)

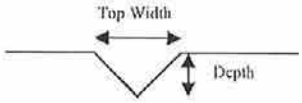
NONE ___ **Open Channel Spillway**
- ___ Trapezoidal
- ___ Triangular
- ___ Rectangular
- ___ Irregular

___ depth
___ bottom (or average) width
___ top width
___

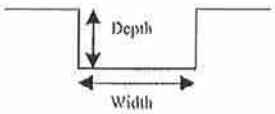
TRAPEZOIDAL



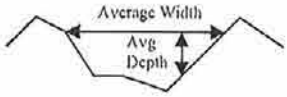
TRIANGULAR



RECTANGULAR

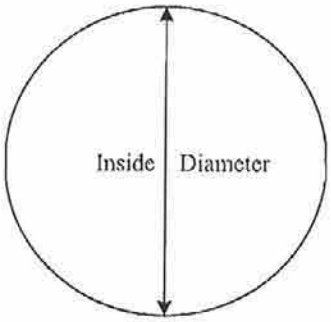


IRREGULAR



YES ___ **Outlet** 3 pipes

8" + 16" + 8" ___ inside diameter



Material
- ___ corrugated metal
- ___ welded steel
- ___ concrete
- HDPE ___ plastic (hdpe, pvc, etc.)
- ___ other (specify) _____

Is water flowing through the outlet? YES ✓ ___ NO ___

___ **No Outlet**

___ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By ARIZONA PUBLIC SERVICE AND URS Corp.

Has there ever been a failure at this site? YES _____ NO ✓

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES _____ NO ✓

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: APS FOUR CORNERS POWER PLANT Date: MAY 20, 2009

Unit Name: LINED DECANT WATER IMPOUNDMENT Operator's Name: ARIZONA PUBLIC SERVICE CO

Unit I.D.: NM 00634 Hazard Potential Classification: High (Significant) Low

Inspector's Name: STEPHEN G BROWN, GEI CONSULTANTS, INC.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections? 6 MONTH	✓		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)? 5211	✓		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A ✓		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)? 5216	✓		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	✓		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?		✓
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	N/A		23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

3. WATER IS PUMPED FROM POND BACK UP TO POWER PLANT. NO DECANT PIPE.

4. NO SPILLWAY PROVIDED

11. Two low areas observed on west dam crest resulting from wind erosion not settlement

17 & 18. INTERIOR SLOPES COVERED BY HDPE GEOSYNTHETIC LINER

19. MINOR EROSION ON CREST, SEE # 11 ABOVE.

21. LEAK DETECTION SYSTEM PROVIDED BETWEEN DUAL HDPE LININGS

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NM 0000019 INSPECTOR STEPHEN G. BROWN
Date MAY 20, 2009 GRI CONSULTANTS, INC.

Impoundment Name LINED DECANT WATER IMPOUNDMENT
Impoundment Company ARIZONA PUBLIC SERVICE, FOUR CORNERS, N.M.
EPA Region 6
State Agency (Field Office) Addresss N/A

Name of Impoundment LINED DECANT WATER IMPOUNDMENT
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ✓ Update ____

	Yes	No
Is impoundment currently under construction?	____	✓
Is water or ccw currently being pumped into the impoundment? WATER BY GRAVITY FLOW.	✓	____

IMPOUNDMENT FUNCTION: DECANT WATER STORAGE

Nearest Downstream Town : Name SHIPROCK
Distance from the impoundment 13 MILES (APPROX.)
Impoundment Location: LONG -108.5124 LAT 36.6831
Longitude ____ Degrees ____ Minutes ____ Seconds
Latitude ____ Degrees ____ Minutes ____ Seconds
State ____ County ____

Does a state agency regulate this impoundment? YES ✓ NO ____

If So Which State Agency? NEW MEXICO OFFICE OF STATE ENGINEER

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

_____ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

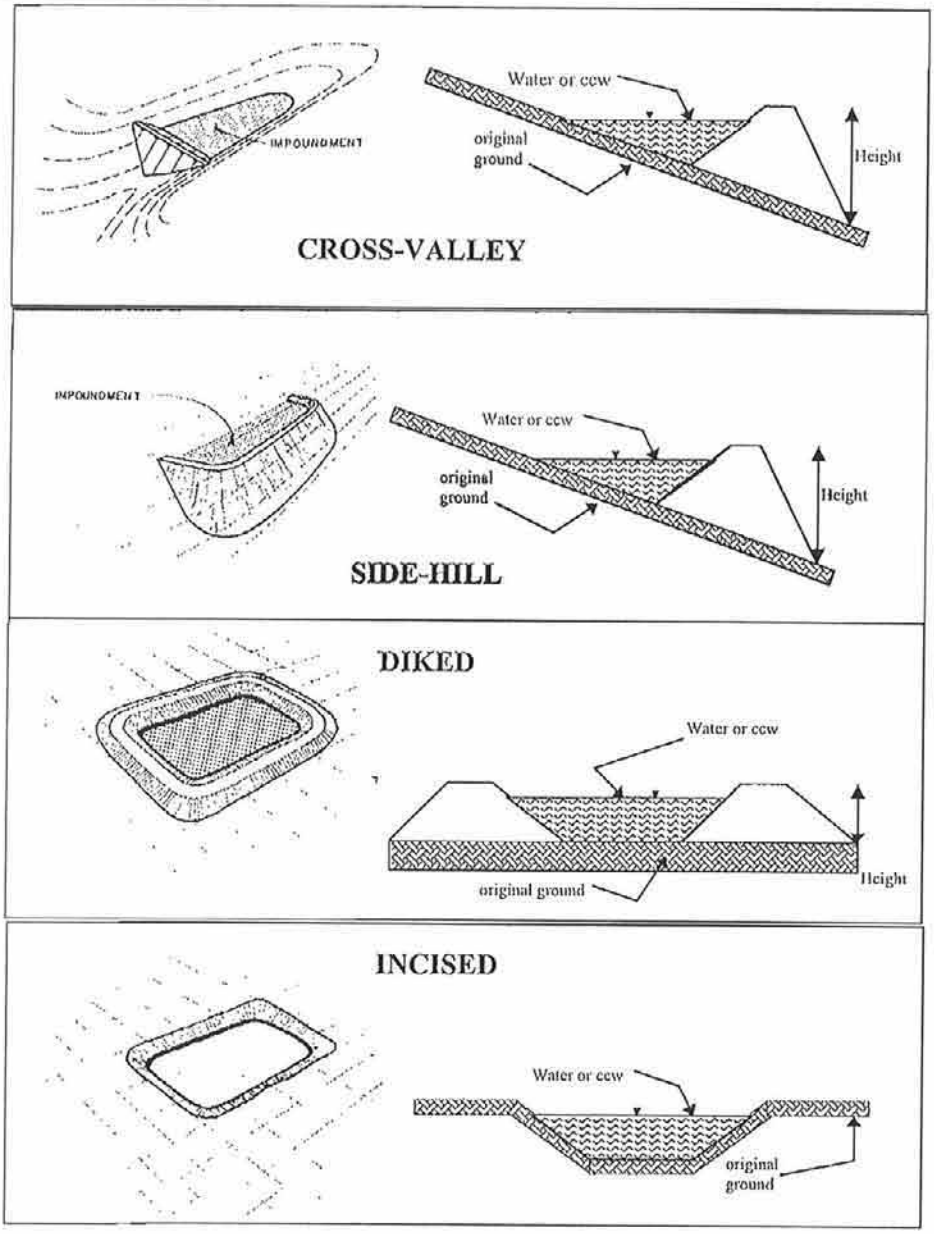
__✓__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

ECONOMIC LOSS AND ENVIRONMENTAL DAMAGE ALONG CHACO RIVER TO THE SAN JUAN RIVER.

CONFIGURATION:



_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height 10 feet
Pool Area 45.1 acres
Current Freeboard 5 feet
Embankment Material COMPACTED CLAY (1)
Liner CLAY WITH DUAL 60 MIL HDPE MEMBRANE
Liner Permeability CLAY 1×10^{-2} ft/day
HDPE 1×10^{-10} ft/day

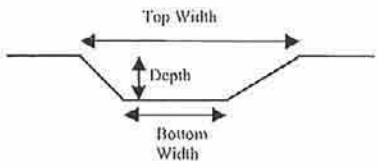
(1) WEST & SOUTH DIKES ARE BOTTOM ASH WITH COMPACTED CLAY LINING

TYPE OF OUTLET (Mark all that apply)

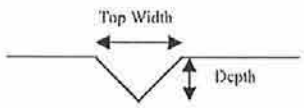
NONE **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

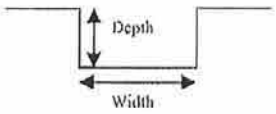
TRAPEZOIDAL



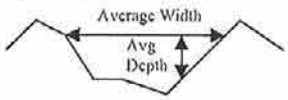
TRIANGULAR



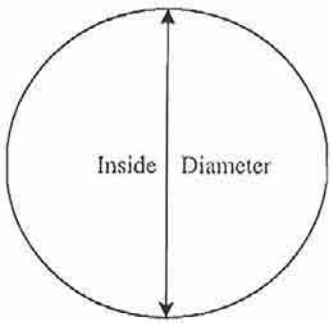
RECTANGULAR



IRREGULAR



NONE **Outlet** – PUMPED DISCHARGE TO POWER PLANT.
_____ inside diameter



Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) _____

Is water flowing through the outlet? YES ✓ NO _____
WHEN PUMPING

✓ **No Outlet** – PUMPED DISCHARGE TO POWER PLANT

_____ **Other Type of Outlet** (specify) _____

The Impoundment was Designed By ARIZONA PUBLIC SERVICE AND URS CORP.

Has there ever been a failure at this site? YES _____ NO ✓

If So When? _____

If So Please Describe : _____

Has there ever been significant seepages at this site? YES _____ NO ✓

If So When? _____

IF So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? _____

If so Please Describe : _____

Appendix C

Inspection Photographs

May 20, 2009

Photo 1 – LAI General view from SE corner, looking west to Hogback in distance.

Photo 2 – LAI Upstream slope of south dam, looking to left. Note HDPE lining. Note lowest dam crest is on west side.

Photo 3 – LAI Upstream slope of east dam. East dam includes a rockfill zone. Note natural bluffs forming upslope side to east.

Photo 4 – LAI Dam crest on east dam.

Photo 5 – LAI Dam crest on south dam, looking to left. Note small bottom ash 'berm' at slope crest for construction traffic safety.

Photo 6 – LAI Exposed part of natural weathered shale that the south and east berm clay cores tie into for seepage control.

Photo 7 – LAI Dam crest on south dam, looking to the right and toward natural high ground and power plant in background.

Photo 8 – LAI Upstream slope on south dam.

Photo 9 – LAI Downstream slope on south dam.

Photo 10 – LAI Upstream slope on south dam and southwest corner of impoundment. Note 'ash fill' placed on west upstream slope for pump to supply water for construction of LAI raise to El. 5258.

Photo 11 – LAI Downstream slope at southwest corner. Note LDWI at lower elevation in background and small pump station structure for decant water.

Photo 12 – LAI Upstream slope on west dam. HDPE pipe is to supply water for construction.

Photo 13 – LAI Crest of west dam. Note small construction material stockpile for dam raise.

Photo 14 – LAI Widening the west dam in preparation for dam raise construction.

Photo 15 – LAI Instrumentation piezometers located on downstream crest of west dam near the decant drop inlet.

Photo 16 – LAI Decant drop inlet structure constructed of 8 ft diameter HDPE manhole. Small HDPE pipe is for water supply to construction of dam raise.

Photo 17 – LAI Looking down into decant drop inlet structure. Note perforations on sides of manhole and 16 inch diameter HDPE outlet pipe located above static water level. An 8 inch outlet pipe is submerged.

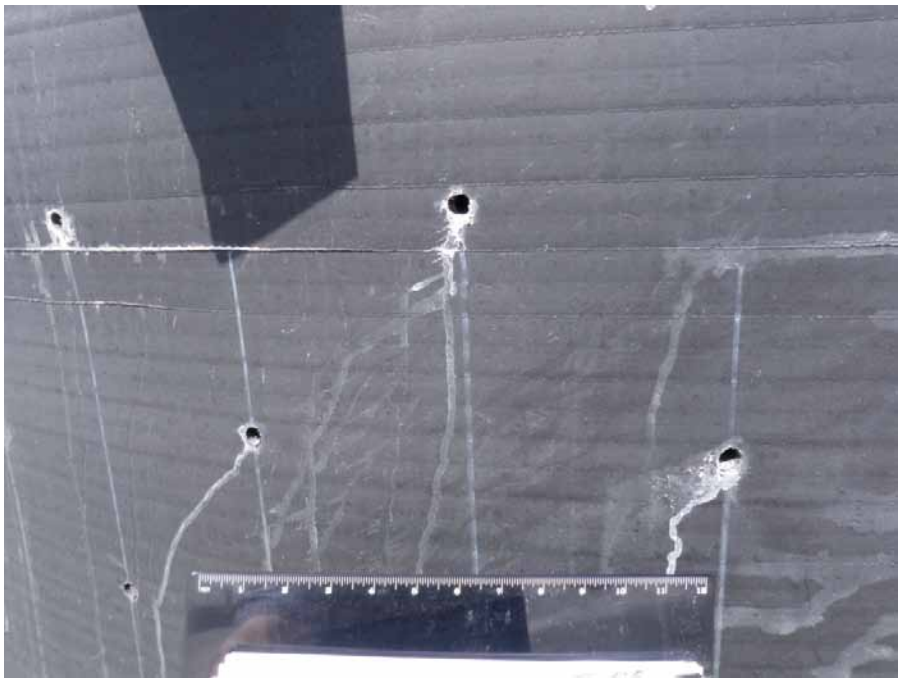


Photo 18 – LAI Close up view of 1/2" dia perforations in decant drop inlet.

Photo 19 – LAI Upstream slope of west dam, looking right.

Photo 20 – LAI Crest of west dam, looking right.

Photo 21 – LAI Upstream slope of west dam, looking right. Note berm to access decant drop inlet structure.

Photo 22 – LAI Upstream slope of north dam. Note tear in HDPE lining caused by construction equipment. APS has noted and plans immediate repair.

Photo 23 – LAI Upstream slope of north dam, looking left from near northeast corner of impoundment.

Photo 24 – LAI Upstream slope of north dam, looking right from near northeast corner of impoundment towards the ash slurry discharge into pond and natural high ground to east.

Photo 25 – LAI Crest of north dam. Note gradually sloping fill between impoundment and Pond #6 to right (out of service).

Photo 26 – LAI Downstream slope and toe of west dam, adjacent to LDWI. Note exposed geogrid strengthening layer that has been excavated for tie-in to dam raise fill.

Photo 27 – LAI Downstream slope and toe of west dam on left, adjacent LDWI dam is on right.

Photo 28 – LAI Downstream slope and toe of west dam looking to right from southeast corner of LAI. Note adjacent LDWI dam on left.

Photo 29 – LAI Downstream slope and toe of south dam, looking to right. Note ponded water near toe that results from seepage from old Pond #4 that underlies the LAI.

Photo 30 – LAI Downstream slope and toe of south dam, looking left toward the tie-in with natural weathered shale high ground.

Photo 31 – LDWI Downstream slope of north dam, looking east to power plant.

Photo 32 – LDWI crest of north dam.

Photo 33 – LDWI upstream slope of north dam. Note dual HDPE lining.

Photo 34 – LDWI upstream slope of west dam.

Photo 35 – LDWI downstream slope of west dam.

Photo 36 – LDWI Crest of west dam. Note areas of eroded crest material due to wind.

Photo 37 – LDWI downstream slope of west dam, looking north.

Photo 38 – LDWI southwest corner of impoundment. Note HDPE pipes used to monitor leak detection system between layers of HDPE lining. Power supply on pole is for automatic leak detection pump system.

Photo 39 – LDWI Upstream slope of south dam. Note bladder dam used to divide reservoir to maintain depth of water over pumping system to convey water to power plant.

Photo 40 – LDWI Crest of south dam.

Photo 41 – LDWI Downstream slope of south dam.

Photo 42 – LDWI Upstream slope of east dam, looking north.

Photo 43 – LDWI Crest of east dam, looking north.

Photo 44 – LDWI Downstream slope of east dam, looking north. White material is lime applied as a dust control measure.

Photo 45 – LDWI Looking directly down slope at pipe from 8" perforated HDPE located in the LAI. Decant water collected by the perforated drain is pumped into the LDWI. Flow was observed to be a few gpm at the time of site visit.

Photo 46 – LDWI Upstream slope of east dam, looking south. Note the 16 inch and 8 inch discharge pipes from the LAI decant intake that are routed across the top of the LDWI dam.

Photo 47 – LDWI Discharge end of 16" and adjacent 8" pipes with decant water from LAI.

Photo 48 – LDWI Suction pipes for pumps recirculating water from LDWI back to power plant.

Appendix D

Reply to Request for Information Under Section 104(e)

THE POWER TO MAKE IT HAPPEN℠

John R. Denman
Senior Vice President
Fossil

Tel. 602-250-3220
Fax 602-250-3902
jdenman@apsc.com

Mail Station 9046
PO Box 53999
Phoenix, Arizona 85072-3999

VIA FEDERAL EXPRESS

March 26, 2009

Mr. Richard Kinch
U.S. Environmental Protection Agency
5th Floor N-5783
Two Potomac Yard
2733 S. Crystal Drive
Arlington, Virginia 22202-2733

Re: Arizona Public Service Company – Corporate Response: Request for Information Under 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e) ("104(e) Request").

Dear Mr. Kinch:

On March 13, 2009, Arizona Public Service Company ("APS") received the above referenced 104(e) Request for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills at additional APS facilities which receive liquid-borne material for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals.

APS has no additional facilities with the types of units that that are covered by the 104(e) Request, other than the Cholla Generating Station and the Four Corners Generation Station – which each received separate information requests.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: _____
Name: John R. Denman
Title: Sr. V.P., Fossil Generation

Attached is Arizona Public Service Company's one page corporate 104(e) response, as well as it's full responses for the Four Corners Generating Station and the Cholla Generating Station.

THE POWER TO MAKE IT HAPPEN℠

John R. Denman
Senior Vice President
Fossil

Tel. 602-250-3220
Fax 602-250-3902
jdenman@apsc.com

Mail Station 9046
PO Box 53999
Phoenix, Arizona 85072-3999

VIA FEDERAL EXPRESS

March 26, 2009

Mr. Richard Kinch
U.S. Environmental Protection Agency
5th Floor N-5783
Two Potomac Yard
2733 S. Crystal Drive
Arlington, Virginia 22202-2733

Re: Arizona Public Service Company – Four Corners Generating Station: Request for Information Under 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e) ("104(e) Request").

Dear Mr. Kinch:

On March 16, 2009, Arizona Public Service Company ("APS") received the above referenced 104(e) Request for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills at the Four Corners Generating Station which receive liquid-borne material for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. APS's response for the Four Corners Generating Station is attached.

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate, and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: 
Name: John R. Denman
Title: Sr. V.P., Fossil Generation

Arizona Public Service Company's 104(e) Response for the Four Corners Generating Station

Plant Description

The Four Corners Generating Station is a five unit, coal fired, 2060 megawatt steam electric power plant. All five generating units have operating particulate control devices and SO_2 scrubbers. As part of its operations, the plant generates residuals and by-products from the combustion of coal.

The plant's ash disposal area consists of an existing Dry Fly Ash Disposal Unit (which does not receive liquid-borne material), a Lined Ash Impoundment, a Lined Water Impoundment, and six old ash impoundments that are no longer in service. The old ash impoundments are dry and contain no free liquid. The old ash impoundments that the plant identifies as #3 and #6 are still inspected by the New Mexico Office of the State Engineer, Dam Safety Bureau, because APS has not yet submitted closure plans for those facilities.

Up to 20% of the fly ash generated at the plant is sold for beneficial reuse.

Bottom Ash Disposal

Wet bottom ash is removed from all five generating unit boilers and is slurried to collection bins for dewatering. The bottom ash is completely dewatered and then hauled by truck to the plant's ash disposal area.

All bottom ash is used by the plant in the construction of embankments for future Lined Ash Impoundment expansions. The embankments are constructed of a 15 foot layer of compacted clay material (water side portion of the embankment) and then ballasted with compacted bottom ash (on the dry side of the embankment).

Fly Ash and Flue Gas Desulphurization ("FGD") Disposal

The fly ash from generating units 1, 2, and 3 is collected by venturi scrubbers (a wet particulate/ SO_2 removal system), slurried to thickener equipment for fly ash and FGD material concentration (water reduction), and then pumped to the plant's Lined Ash Impoundment for dewatering. The decanted water flows by gravity through a filter built into the Lined Ash Impoundment, and then into the Lined Water Impoundment.

The fly ash from generating units 4 and 5 is collected by fabric filters (dry collection) and is disposed of dry at a lined, dry fly ash accumulation area (that that does not receive liquid-borne material).

The SO_2 from generating units 4 and 5 is removed from the flue gas by a wet spray tower scrubber system. The resulting FGD material is then pumped to thickener equipment, where it is concentrated before being pumped to the plant's Lined Ash Impoundment, where it is commingled with fly ash and FGD material from generating units 1, 2, and 3.

Low Volume Waste Water System

Water from the plant's low volume waste water system is pumped into a collection system sump from several sources within the plant. The water then flows out of the collection sump by gravity and flows through the Low Volume Waste Water Decant Cells before flowing into the plant's Low Volume Waste Water Pond.

Impoundment Descriptions

Lined Ash Impoundment

The Lined Ash Impoundment is constructed on top of the old ash impoundments identified by the plant as #3 and #4. The Lined Ash Impoundment's dikes are constructed of compacted clay material, in accordance with dam construction specifications approved by the New Mexico Office of the State Engineer, Dam Safety Bureau. The dikes are built on top of the clay dikes used for old ash impoundments #3 and #4. The Lined Ash Impoundment is constructed with a 60 Mil HDPE liner that lines the entire impoundment area, including the dikes.

Lined Water Impoundment

The Lined Water Impoundment is constructed on top of the old ash impoundment identified by the plant as #3. The Lined Water Impoundment's dikes are constructed of compacted clay material in accordance with dam construction specifications approved by the New Mexico Office of the State Engineer, Dam Safety Bureau. The dikes are built on top of the clay dikes used for old ash impoundment #3. The Lined Water Impoundment is constructed with two 60 Mil HDPE liner layers that lines the entire impoundment area, including the dikes. The second HDPE liner barrier also includes a leak detection system. The Lined Water Impoundment contains no solid ash material and is not an ash management unit. But due to the breadth of the impoundment definition and subsequent EPA guidance on chemicals of concern, APS is reporting on this unit.

Upper Retention Sump

The Upper Retention Sump is a below grade compacted soil cement basin that is part of the generating unit 4 and 5 SO_2 scrubber system. It is used for temporary surge capacity of coal combustion products and FGD materials from the normal waste disposal processes of the scrubbers. The material in the basin is returned to the generating unit 4 and 5 thickener equipment, and then sent to the Lined Ash Impoundment.

Low Volume Waste Water System Decant Cells

The Low Volume Waste Water System Decant Cells are below grade cells constructed with engineered fill (bottom ash placed on top of clay material). Each of the three cells contains floor drains (French type drains) to decant water from the solids contained in the plant's low volume waste water system. The decant cells help remove solids from the low volume waste water, prior to the water entering the Low Volume Waste Water Pond.

Low Volume Waste Water Pond

The Low Volume Waste Water Pond is a below grade water treatment pond. The pond allows solids in the water to settle, for later dredging (prior to the water flowing back into the plant's cooling lake).

104(e) Questions

Please provide the information requested below for each surface impoundment or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. This includes units that no longer receive coal combustion residues or by-products, but still contain free liquids.

1. Relative to the National Inventory of Dams criteria for High, Significant, Low, or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit(s) does not have a rating, please note that fact.

Lined Ash Impoundment

The rating, which is designated by the New Mexico Office of the State Engineer, Dam Safety Bureau, which regulates the unit, is "Significant Hazard Potential." The basis for the rating is set forth in the New Mexico Administrative Code ("N.M.A.C."), Title 19, Chapter 25, Part 12, Section 19.25.12.10 attached to this response as Exhibit A.

Lined Water Impoundment

The rating, which is designated by the New Mexico Office of the State Engineer, Dam Safety Bureau, which regulates the unit, is "Significant Hazard Potential." The basis for the rating is set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.12.10 attached to this response as Exhibit A.

Upper Retention Sump

Because the Upper Retention Sump does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., the unit is not regulated as a dam.

Low Volume Waste Water System Decant Cells

Because none of the Low Volume Waste Water Decant Cells meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., the units are not regulated as dams.

Low Volume Waste Water Pond

Because the Low Volume Waste Water Pond does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., the unit is not regulated as a dam.

2. What year was each management unit commissioned and expanded?

Lined Ash Impoundment

Commissioned (in-service) in 2003. Expanded in 2007.

Lined Water Impoundment

Commissioned (in-service) in 2003.

Upper Retention Sump

Commissioned (in-service) in 1984.

Low Volume Waste Water System Decant Cells

Commissioned (in-service) in 2004.

Low Volume Waste Water Pond

Commissioned (in-service) in 1979.

3. What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).

Lined Ash Impoundment

(1) Fly ash; (2) bottom ash: (3) boiler slag; (4) flue gas emission control residuals; and (5) other. Other types include: boiler acid cleaning waste, treated sewage, chemical metal cleaning wastes, air preheater wash, co-disposal waste (permitted by 40 C.F.R. § 261.4(b)(4)), turbine foam cleaning waste, and stack flue gas residues.

Lined Water Impoundment

(4) Flue gas emission control residuals and (5) other. Other types include blow dust/dirt.

Upper Retention Sump

(4) Flue gas emission control residuals and (5) other. Other types include scrubber area wash down, dirt, and coal dust.

Low Volume Waste Water System Decant Cells

(1) Fly ash; (2) bottom ash: (4) flue gas emission control residuals; and (5) other. Other types include: boiler blow down, back pass boiler wash down, metal cleaning waste, coal dust, dirt, de minimus lubricants, demineralizer regeneration wastes, storm water, corrosion and flocculation chemicals, and potable water flushings.

Low Volume Waste Water Pond

(1) Fly ash; (2) bottom ash: (4) flue gas emission control residuals; and (5) other. Other types include: boiler blow down, back pass boiler wash down, metal cleaning waste, coal dust, dirt, de minimus lubricants, demineralizer regeneration wastes, storm water, corrosion and flocculation chemicals, and potable water flushings.

4. Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?

Lined Ash Impoundment

The Lined Ash Impoundment was designed by a Professional Engineer. Its construction was under the supervision of a Professional Engineer. Inspection and monitoring of the safety of the Lined Ash Impoundment is under the supervision of a Professional Engineer.

Lined Water Impoundment

The Lined Water Impoundment was designed by a Professional Engineer. Its construction was under the supervision of a Professional Engineer. Inspection and monitoring of the safety of the Lined Water Impoundment is under the supervision of a Professional Engineer.

Upper Retention Sump

The Upper Retention Sump was not designed by a Professional Engineer. Its construction was not under the supervision of a Professional Engineer. Inspection and monitoring of the safety of the Upper Retention Sump is not under the supervision of a Professional Engineer.

Low Volume Waste Water System Decant Cells

The Low Volume Waste Water System Decant Cells were designed by a Professional Engineer. Their construction was under the supervision of a Professional Engineer. Inspection and monitoring of the safety of the Low Volume Waste Water System Decant Cells is under the supervision of a Professional Engineer.

Low Volume Waste Water Pond

The Low Volume Waste Water Pond was not designed by a Professional Engineer. Its construction was not under the supervision of a Professional Engineer. Inspection and monitoring of the safety of the Low Volume Waste Water Pond is under the supervision of a Professional Engineer.

5. When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company plans an assessment or evaluation in the future, when is it expected to occur?

APS Engineers who conducted the evaluations/assessments below are registered with the State of New Mexico as Professional Engineers, in accordance with the requirements of the New Mexico Board of Technical Registration. Also, in accordance with its dam safety regulations (N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.12.13 A), the New Mexico Office of State Engineer, Dam Safety Bureau, has accepted each engineer as qualified for design, construction, maintenance, and operational oversight of the dam structures.

Lined Ash Impoundment

APS last assessed or evaluated the safety of the Lined Ash Impoundment in January 2009. The individual who conducted the assessment/evaluation was a Four Corners plant Professional Engineer. No safety deficiencies were identified. The next assessment/evaluation is scheduled for July 2009.

Lined Water Impoundment

APS last assessed or evaluated the safety of the Lined Water Impoundment in January 2009. The individual who conducted the assessment/evaluation was a Four Corners plant Professional Engineer. No safety deficiencies were identified. The next assessment/evaluation is scheduled for July 2009.

Upper Retention Sump

Because the Upper Retention Sump does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety assessments/evaluations are not necessary for this sort of structure.

Low Volume Waste Water System Decant Cells

Because the Low Volume Waste Water System Decant Cells do not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety assessments/evaluations are not necessary for these sorts of structures.

Low Volume Waste Water Pond

Because the Low Volume Waste Water Pond does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety assessments/evaluations are not necessary for this sort of structure.

6. When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.

Lined Ash Impoundment

The New Mexico Office of State Engineer, Dam Safety Bureau, last inspected the Lined Ash Impoundment on October 4, 2007. Inspections by this agency are not planned and are unannounced. A copy of the most recent official inspection report is attached as Exhibit B. All recommended actions indicated on the report have been completed.

Lined Water Impoundment

The New Mexico Office of State Engineer, Dam Safety Bureau, last inspected the Lined Water Impoundment on October 4, 2007. Inspections by this agency are not planned and are unannounced. A copy of the most recent official inspection report is attached as Exhibit C. All recommended actions indicated on the report have been completed.

Upper Retention Sump

Because the Upper Retention Sump does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety inspections are not conducted.

Low Volume Waste Water System Decant Cells

Because the Low Volume Waste Water System Decant Cells do not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety inspections are not conducted.

Low Volume Waste Water Pond

Because the Low Volume Waste Water Pond does not meet the definition of a dam, as set forth in the N.M.A.C., Title 19, Chapter 25, Part 12, Section 19.25.7 H., safety inspections are not conducted.

7. Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issue(s) with the management unit(s), and, if so describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.

Lined Ash Impoundment

No.

Lined Water Impoundment

No.

Upper Retention Sump

Not applicable. See response to Question #6.

Low Volume Waste Water System Decant Cells

Not applicable. See response to Question #6.

Low Volume Waste Water Pond

Not applicable. See response to Question #6.

8. What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.

Lined Ash Impoundment

Surface area: 75 Acres.

Total storage capacity: 3,870,000 cubic yards.

Volume of materials currently stored: 3,406,600 cubic yards.

Date volume measurement was taken: December 31, 2008.

Maximum height: 83 feet (note, however, that the Lined Ash Impoundment is constructed on top of old ash impoundment #3, which comprises the first 43 feet of the dam height).

Lined Water Impoundment

Surface area: 45.1 Acres.

Total storage capacity: 435 acre-feet.

Volume of materials currently stored: 284 acre-feet.

Date volume measurement was taken: March 17, 2009.

Maximum height: 90 feet (note, however, that the Lined Water Impoundment is constructed on top of old ash impoundment #3, which comprises the first 80 feet of the dam height).

Upper Retention Sump

Surface area: 1.07 acres.

Total storage capacity: 17,265 cubic yards.

Volume of materials currently stored: 6,900 cubic yards.

Date volume measurement was taken: March 12, 2009.

Maximum height: Below grade, 0 feet.

Low Volume Waste Water System Decant Cells

Surface area: 0.63 acres.

Total storage capacity: 6,419 cubic yards.

Volume of materials currently stored: 1,100 cubic yards.

Date volume measurement was taken: March 12, 2009.

Maximum height: 6 feet.

Low Volume Waste Water Pond

Surface area: 13.7 acres.

Total storage capacity: 221,000 cubic yards.

Volume of materials currently stored: 88,400 cubic yards.

Date volume measurement was taken: March 17, 2009.

Maximum height: Below grade, 0 feet.

9. Please provide a brief history of known spills or unpermitted releases from the unit within the last ten years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).

Lined Ash Impoundment

There have been no known spills or unpermitted releases within the last ten years.

Lined Water Impoundment

There have been no known spills or unpermitted releases within the last ten years.

Upper Retention Sump

There have been no known spills or unpermitted releases within the last ten years.

Low Volume Waste Water System Decant Cells

There have been no known spills or unpermitted releases within the last ten years.

Low Volume Waste Water Pond

There have been no known spills or unpermitted releases within the last ten years.

10. Please identify all current legal owner(s) and operator(s) at the facility.

Owner/Operator	Arizona Public Service Company.
Owner	Public Service Company of New Mexico
Owner	El Paso Electric
Owner	Tucson Electric Power
Owner	Salt River Project
Owner	Southern California Edison

D. For inspecting construction of a dam the fee shall be $100/8-hour day and actual and necessary traveling expenses.

E. For filing a proof of completion of works for a dam the fee shall be $25.

F. For filing a change of ownership for a dam the fee shall be $5.

G. For copies of dam safety records up to 11 inches by 17 inches the fee shall be $0.20 per copy.

H. For copies of dam safety records greater than 11 inches by 17 inches the fee shall be $3.00 per copy.

[19.25.12.8 NMAC - N, 3/31/2005]

19.25.12.9 SIZE CLASSIFICATION: A dam shall be less than or equal to the maximum height and storage to qualify for the size classification.

A. Small: A small dam is greater than 10 feet but less than or equal to 40 feet in height, or greater than 10 acre-feet but less than or equal to 1000 acre-feet of storage.

B. Intermediate: An intermediate dam is greater than 40 feet but less than or equal to 100 feet in height, or greater than 1000 acre-feet but less than or equal to 50,000 acre-feet of storage.

C. Large: A large dam is greater than 100 feet in height, or greater than 50,000 acre-feet of storage.

[19.25.12.9 NMAC - N, 3/31/2005]

19.25.12.10 HAZARD POTENTIAL CLASSIFICATION: The hazard potential classification is a rating for a dam based on the potential consequences of failure. The rating is based on loss of life, damage to property and environmental damage that is likely to occur in the event of dam failure. No allowances for evacuation or other emergency actions by the population should be considered. The hazard potential classification is not a reflection of the condition of the dam.

A. Low hazard potential: Dams assigned the low hazard potential classification are those dams where failure or misoperation results in no probable loss of life and low economic and/or environmental losses. Losses are principally limited to the dam owner's property.

B. Significant hazard potential: Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in populated areas with significant infrastructure.

C. High hazard potential: Dams assigned the high hazard potential classification are those dams where failure or misoperation will probably cause loss of human life.

[19.25.12.10 NMAC - N, 3/31/2005]

19.25.12.11 DESIGN OF A DAM: Any person, association or corporation, public or private, the state, or the United States that is intending to construct a dam shall submit an application to construct and operate a dam and supporting documentation acceptable to the state engineer. This section primarily addresses the design and construction of embankment dams. Other types of dams shall conform to sound engineering principles and current state of the practice. Because each site, design and operating practice is unique, waivers of specific requirements in this section will be considered on a case-by-case basis. Request for waiver shall be in writing accompanied with documentation justifying the request. If the request is not justified to the satisfaction of the state engineer the request will be denied. Construction shall not begin until the state engineer has accepted the supporting documentation and approved the application with construction and operation conditions. The application and supporting documentation shall include:

A. Application: An application form shall be completed with original signature of the dam owner and accompanied with a filing fee in accordance with Subsection A of 19.25.12.8 NMAC. The form will be the only information available to the public before the project is approved for construction. All other supporting documentation is considered draft until accepted by the state engineer. A plan review fee in accordance with Subsection B of 19.25.12.8 NMAC shall accompany the submittal of the design report, construction drawings and specifications. A detailed estimate of the construction cost for the proposed dam and appurtenant structures shall be submitted in support of the plan review fee.

B. Water right: A water right is required for water impounded by the dam. If the dam owner has a permit for the diversion of water, documentation addressing the necessity for storage, diversion periods and release conditions for the reservoir may be required. This requirement is waived for flood control dams that do not detain

MEMORANDUM
OFFICE OF THE STATE ENGINEER
Dam Safety Bureau

DATE: October 30, 2007

TO: Elaine C. Pacheco, P.E., Chief, Dam Safety Bureau EC

FROM: Sushil K. Chaudhary, D.Eng., P.E., Dam Safety Engineer

SUBJECT: Inspection of Lined Ash Impoundment (a.k.a. Lined Ash Pond), San Juan County, OSE File No. D-634

On October 4, 2007, I inspected Lined Ash Impoundment (LAI) dam. The purpose of the dam is to store tailings from the coal fired power plant that is rich in fly ash. The liquid is decanted into the downstream pond. Characteristics of the dam, verified from visual inspection and research of available documents, are shown on a Dam Inventory Form. Observations made during the inspection are shown on the attached Inspection Checklist.

Recommended Actions

1. Please submit Construction Completion Report for 5248-Lift Elevation, which shall include a summary of construction activities, descriptions of problems and their solutions, summary of materials test data, captioned and dated construction photographs, and a certificate that the dam as constructed is safe for the intended use per conditions of construction permit approval dated February 25, 2003.
2. Please submit as-built drawings reflecting present cross-sections of dam embankments per conditions of construction permit approval dated February 25, 2003.
3. Please submit "Proof of Completion of Works – Dam" form with original signatures for 5248-Lift Elevation.
4. Please submit details of instrumentation, including installation of new vibrating wire piezometers.
5. Please prepare and submit "Operation and Maintenance Manual" and "Emergency Action Plan" prior to June 30, 2008 per conditions of construction permit approval dated February 25, 2003.

Operation and Maintenance Manual and Emergency Action Plan

There is currently no Operation and Maintenance Manual (O&M) or Emergency Action Plan (EAP) on file with OSE Dam Safety Bureau. The OSE adopted new rules and regulations for dams, effective March 31, 2005. The rules and regulations are part 12 of 19.25 NMAC and are titled Dam Design, Construction and Dam Safety. Section 19.25.12.21 NMAC establishes O&M and EAP requirements for existing dams. Conditions of construction permit approval dated February 25, 2003 require this structure to have an approved Operation and Maintenance Manual and an Emergency Action Plan in place by June 30, 2008.

New Mexico Office Of The State Engineer
Dam Safety Bureau
Tailings Dam Inspection Checklist

County: San Juan	**Dam Name:** Lined Ash Impoundment	**OSE No.:** D-634	**Fed ID No.:** NM00634
Inspection Performed By: Sushil K. Chaudhary	**Inspection Date:** 10/4/07	**Last Inspection Date:** 3/28/06	
Owner Name: APS Four Corners Power Plant	**Owner Address:** P.O. Box 355, Mail Station 4913 Fruitland, NM 87416	**Owner Contact:** David Bloomfield **Owner Phone No.:** 505-598-8405	
Method of Construction: Compacted bottom ash embankment in stages	**Hazard Class:** Significant	**Hazard Class Appropriate:** Yes☒ No☐	
Dam Location: APS Four Corners Power Plant		**Latitude:** 36.6849	**Longitude:** -108.5066
Weather: Partly cloudy	**Attendees:** David Bloomfield, Bruce Salisbury		

1. General Conditions	Satisfactory	Needs Attention	N/A	Remarks:
a. Access for O & M	☒	☐	☐	
b. Unauthorized access restricted	☒	☐	☐	
c. No unauthorized alterations	☒	☐	☐	

2. Interior Slope	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Distortion or cracking	☒	☐	☐	
d. Adequate freeboard	☒	☐	☐	

3. Dam Crest	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Adequate width maintained	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	

4. Downstream Slope	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Rodent control	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	
e. Seepage control	☒	☐	☐	

5. Downstream Area	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Rodent control	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	
e. Seepage or boils	☒	☐	☐	
f. Drains or Wells	☐	☐	☒	Est. gpm

Dam Name: Lined Ash Impoundment **Inspection Date:** 10/4/07 **File No.** D-634

6. Abutment Contacts	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion, cracks, or slides	☒	☐	☐	
b. Woody vegetation	☒	☐	☐	
c. Distortion or cracking	☒	☐	☐	
d. Seepage	☒	☐	☐	
e. Drains or Wells	☐	☐	☒	Est. gpm

7. Tailings Storage Area	Satisfactory	Needs Attention	N/A	Remarks:
a. Adequate beach maintained	☐	☐	☒	Embankment is lined, beach not required
b. Tailing placement method	☒	☐	☐	
c. Tailing placement rate	☒	☐	☐	
d. Sediment level	=			
e. Water level	=			

8. Intake Structure	Type of Structure: Decant structure (CMP drop inlet with ports filtered by bottom ash)			
	Satisfactory	Needs Attention	N/A	Remarks:
a. Concrete condition	☐	☐	☒	
b. Reinforcement encasement	☐	☐	☒	
c. Coating adequacy	☐	☐	☒	
d. Leakage	☐	☐	☒	
e. Trash rack condition	☐	☐	☒	
f. Inlet unobstructed	☒	☐	☐	Inlet ports are covered with bottom ash filter
g. Gates operative	☐	☐	☒	
h. Woody vegetation	☒	☐	☐	
Number of intake ports		Number of ports open		

9. Outlet Conduit	Type of Conduit: 18-in, 8-in, 8-in HDPE pipes			Estimated Discharge:
	Interior inspection: Yes ☐ Date		No ☒	
	Satisfactory	Needs Attention	N/A	Remarks:
a. Overall Condition	☐	☐	☐	Conduits were discharging liquid into the downstream decant pond.
b. Condition of surfaces	☐	☐	☐	
c. Reinforcement encasement	☐	☐	☐	
d. Clear of obstructions	☐	☐	☐	
e. Joint Condition	☐	☐	☐	
f. Leakage	☐	☐	☐	
g. Alignment	☐	☐	☐	

10. Instrumentation	Satisfactory	Needs Attention	N/A	Remarks:
a. Structure instrumented	☒	☐	☐	
b. Monitoring performed	☒	☐	☐	
c. Piezometers	☐	☒	☐	Details of the installation of new vibrating wire piezometers must be submitted for review
d. Settlement monuments	☐	☐	☒	
e. Other	☐	☐	☐	

Overall Remarks:	Lined Ash Impoundment embankments are in satisfactory condition. However, the as-built drawings reflecting present cross-sections must be submitted. Details of new vibrating wire piezometers must be submitted for OSE review and approval. Construction Completion Report for the 5248-Lift elevation must be submitted.

Signature: Sushil Chaudhary Date: 10/30/07

MEMORANDUM
OFFICE OF THE STATE ENGINEER
Dam Safety Bureau

DATE: October 31, 2007

TO: Elaine C. Pacheco, P.E., Chief, Dam Safety Bureau

FROM: Sushil K. Chaudhary, D.Eng., P.E., Dam Safety Engineer

SUBJECT: Inspection of Lined Decant Water Pond, San Juan County, OSE File No. D-635

On October 4, 2007, I inspected Lined Decant Water Pond Dam. The purpose of the dam is to store decant water from the coal fired power plant tailings rich in fly ash. Characteristics of the dam, verified from visual inspection and research of available documents, are shown on a Dam Inventory Form. Observations made during the inspection are shown on the attached Inspection Checklist.

Recommended Actions

1. Please submit "Proof of Completion of Works – Dam" form with original signatures and a filing fee of $25.00 per conditions of construction permit approval dated February 25, 2003 by December 31, 2007. The Office of the State Engineer (OSE) has notified Mr. David Bloomfield of Arizona Public Service Company (APS) of this deficiency with the letter dated July 1, 2004. No response from APS is on file with the OSE. The OSE has not issued the Certificate of Construction and the Operating License for Lined Decant Water Pond. The pond is already in full operation.
2. Please prepare and submit "Operation and Maintenance Manual" and "Emergency Action Plan" prior to June 30, 2008 per conditions of construction permit approval dated February 25, 2003.

Operation and Maintenance Manual and Emergency Action Plan

There is currently no Operation and Maintenance Manual (O&M) or Emergency Action Plan (EAP) on file with OSE Dam Safety Bureau. The OSE adopted new rules and regulations for dams, effective March 31, 2005. The rules and regulations are part 12 of 19.25 NMAC and are titled Dam Design, Construction and Dam Safety. Section 19.25.12.21 NMAC establishes O&M and EAP requirements for existing dams. Conditions of construction permit approval dated February 25, 2003 require this structure to have an approved Operation and Maintenance Manual and an Emergency Action Plan in place by June 30, 2008.

Spillway

This structure does not have a spillway. The dam is designed to contain spillway design flood (half-PMP event based on HMR 49).

Inspection Findings

Overall Dam Condition
Based on the inspection, Lined Decant Water Pond Dam is in "Satisfactory" condition.

Hazard Potential Classification
The Hazard Class for this structure is listed as SIGNIFICANT. The hazard class is appropriate.

Monitoring Data
The west embankment has a number of standpipe type piezometers which were likely installed to monitor pore pressure during embankment construction. The Lined Decant Water Pond has HDPE liner with leak detection system. The piezometers, therefore, may not record any water level. However, the piezometers should still be read occasionally as they represent one more layer of tools to indicate liner leak. Details of piezometer installation are not available on file with the OSE.

Sushil Chaudhary

Sushil K. Chaudhary, D.Eng., P.E.
Dam Safety Bureau

SKC

New Mexico Office Of The State Engineer
Dam Safety Bureau
Inspection Checklist

County: San Juan	**Dam Name:** Lined Decant Water Pond	**OSE No.:** D-635	**Fed ID No.:** NM00634
Inspection Performed By: Sushil K. Chaudhary	**Inspection Date:** 10/4/07	**Last Inspection Date:** 3/28/06	
Owner Name: APS Four Corners Power Plant	**Owner Address:** P.O. Box 355, Mail Station 4913 Fruitland, NM 87416	**Owner Contact:** David Bloomfield **Owner Phone No.:** 505-598-8405	
Purpose of Dam: Decant water storage	**Hazard Class:** Significant	**Hazard Class Appropriate:** Yes ☒ No ☐	
Dam Location: APS Four Corners Power Plant		**Latitude:** 36.6831	**Longitude:** -108.5124
Weather: Partly cloudy	**Attendees:** David Bloomfield, Bruce Salisbury		

1. General Conditions	Satisfactory	Needs Attention	N/A	Remarks:
a. Access for O & M	☒	☐	☐	
b. Unauthorized access restricted	☒	☐	☐	
c. No unauthorized alterations	☒	☐	☐	

2. Interior Slope	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	Interior is lined with liner
b. Woody vegetation control	☒	☐	☐	
c. Distortion or cracking	☒	☐	☐	
d. Adequate freeboard	☒	☐	☐	

3. Dam Crest	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Adequate width maintained	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	

4. Downstream Slope	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Rodent control	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	
e. Seepage control	☒	☐	☐	

5. Downstream Area	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion control	☒	☐	☐	
b. Woody vegetation control	☒	☐	☐	
c. Rodent control	☒	☐	☐	
d. Distortion or cracking	☒	☐	☐	
e. Seepage or boils	☒	☐	☐	
f. Drains or Wells	☐	☐	☒	Est. gpm

Dam Name: Lined Decant Water Pond **Inspection Date:** 10/4/07 **File No.** D-635

6. Abutment Contacts	Satisfactory	Needs Attention	N/A	Remarks:
a. Erosion, cracks, or slides	☒	☐	☐	
b. Woody vegetation	☒	☐	☐	
c. Distortion or cracking	☒	☐	☐	
d. Seepage	☒	☐	☐	
e. Drains or Wells	☐	☐	☒	Est. gpm

7. Reservoir	Satisfactory	Needs Attention	N/A	Remarks:
a. Developed/Encroachment	☐	☐	☐	It is a perimeter pond
b. Banks and slopes stable	☐	☐	☐	
c. Obstruction or debris	☐	☐	☐	
d. Sediment level	=			
e. Water level	=			

8. Instrumentation	Satisfactory	Needs Attention	N/A	Remarks:
a. Structure instrumented	☒	☐	☐	
b. Monitoring performed	☒	☐	☐	
c. Piezometers	☒	☐	☐	
d. Settlement monuments	☐	☐	☒	
e. Other	☒	☐	☐	Leak detection system for liner system

Overall Remarks:	Lined Decant Water Pond embankments are in satisfactory condition

Signature: Sushil Chaudhary

Date: 10/31/07